

A Progress Report on Contracted Electricity Supply

FOURTH QUARTER 2016

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Glossary of Acronyms

ABESA	Atikokan Biomass Energy Supply Agreement
ACES	Accelerated Clean Energy Supply Contract
ABPRIA	Amended and Restated Bruce Power Rehabilitation Implementation Agreement
BPRIA	Bruce Power Rehabilitation Implementation Agreement
CO	Commercial Operation
CES	Clean Energy Supply Contract
CHP	Combined Heat and Power (Cogeneration)
CHP I	Combined Heat and Power Agreement (Tranche 1)
CHP III	Combined Heat and Power Agreement (Tranche 3)
CHPSOP	Combined Heat and Power Standard Offer Program
Dx	Distribution Grid Connection (LDC embedded)
EFW	Energy from Waste
EMCES	Early Mover Clean Energy Supply Contract
FIT	Feed-in Tariff Program
GS	Generating Station
GEIA	Green Energy Investment Agreement Power Purchase
HCI	Hydroelectric Contract Initiative
HESA	Hydroelectric Energy Supply Agreement
HESOP	Hydroelectric Standard Offer Program
IESO	Independent Electricity System Operator
LESA	Lennox Energy Supply Agreement
LRP I	Large Renewable Procurement Program (Tranche 1)
microFIT	micro Feed-in Tariff Program
MCOD	Milestone Commercial Operation Date
MW	Megawatts
NTP	Notice-to-Proceed with Construction
NUG	Non-Utility Generator
NYRP	Northern York Region Peaking Generation Contract
OEFC	Ontario Electricity Financial Corporation
OPG	Ontario Power Generation
Pre-NTP	Pre-Notice to Proceed (contracts have been offered and accepted)
RES I	Renewable Energy Supply Contract (Tranche 1)
RES II	Renewable Energy Supply Contract (Tranche 2)
RES III	Renewable Energy Supply Contract (Tranche 3)
RESOP	Renewal Energy Standard Offer Program
SC/CC	Simple Cycle/Combined Cycle
TBESA	Thunder Bay Biomass Energy Supply Agreement
Tx	Transmission Grid Connection
UD	Under Development

Preface

On January 1, 2015, the Ontario Power Authority (OPA) and the Independent Electricity System Operator (IESO) were merged into a single organization that combines the mandates of both its predecessors under the name of the IESO. All contractual obligations of the OPA have moved to the new organization.

Together with its partners, the IESO ensures that electricity needs are met for the benefit of Ontario, both now and in the future. It procures electricity supply from diverse resources and facilitates the measures needed to achieve ambitious conservation targets, in accordance with ministerial direction. The IESO reliably operates the electricity system in real time and plans for a dependable, sustainable system for the long term.

In accordance with Ontario Energy Board Order EB-2005-0489 dated March 3, 2006, the IESO posts regular updates on its website on the progress of procurement initiatives, including the progress of selected projects, subject to confidentiality constraints. The [Progress Report on Contracted Electricity Supply](#) is updated quarterly to provide the status of the IESO's contracted electricity supply projects and procurement initiatives. The numbers and information provided in this report include only electricity projects and initiatives in Ontario contracted by the IESO.

Parameters of Reported Contract Data

The data in this report are drawn from different types of contracts for supply held by the IESO.¹ They provide the sum total of all contracts, classified by facilities that are grid-connected and embedded, and by facilities that have achieved commercial operation or are under development.

These data may differ from IESO supply mix data², which describe all grid-connected generation that has completed the market entry process and a small amount of embedded generation that participates in the IESO-administered market. While third parties sometimes use IESO contract data as part of their data inputs, they may lack the detailed information needed to reconcile accurately with figures reported here. Some of these important details could include:

- contracted capacities are used in this report, not installed capacities³
- the in-service forecasts made in this report are based on the Milestone Commercial Operation Date (MCOD), which is a contractual date
- facilities reported as having achieved commercial operation have fulfilled their required contractual obligations to begin generating electricity. However, when the supplier is also a registered IESO market participant, it is not listed as a new facility in operation until it has completed commissioning and the market registration process.⁴

Confidentiality Constraints

The IESO is legally bound by confidentiality terms that differ between contracts, therefore the types of data that can be shared are not always the same.

¹ The data reflect the contractual obligations of the IESO which continue until contracts have ended (expired or terminated), or until facilities have been decommissioned and the contracts have been closed out. Contract data therefore do not change, whether facilities are not producing energy (offline) or are in a decommissioning stage.

² The [supply mix](#) data are based on the [IESO-18 Month Outlook](#) which uses different methodologies to define resource capabilities.

³ Installed capacity refers to the maximum power that a generation facility can supply, in MW. Contracted capacity is the amount of power that the IESO has agreed to purchase from suppliers under contract for a fixed term. Contract capacities are sometimes different from installed capacities. Therefore, data in the IESO 18-Month Outlook and [Generator Output and Capability Report](#) may reflect capacity values that are different from data in this report.

⁴ Generators registered as Market Participants are required to comply with obligations relating to connection to the IESO-controlled grid and to participation in the IESO-administered markets. For more information, see the [IESO Market Rules – Chapter 4: Grid Connection Requirements](#).

Assumptions and Caveats

- Contract data may change as frequently as daily. The data used to construct this report are based on the information as of the end of the specified quarter
- In some cases, mostly with hydroelectric projects, there are expansions to facilities that are already in commercial operation. These expansion projects that are under development are counted as part of the original contract in order to avoid double counting of the total number of contracts
- The number of contracts does not always represent the number of physical facilities. In some cases, a single contract may include multiple generating facilities (e.g. Site 1, Site 2)
- Contracts executed with non-utility generators (NUGs) that are under contract with the Ontario Electricity Financial Corporation (OEFC) are not reported as an IESO contract until:
 - the IESO contract term has commenced
 - all conditions required for commercial operation approval have been satisfied.
- The data in this report include all embedded generation under contract with the IESO. The IESO Current Supply Mix data do not include all embedded generation, as embedded generators generally do not participate in the IESO-administered market
- All contracted assets that are connected to the transmission grid, regardless of size, are counted as transmission data in this report
- Some numbers are rounded and may not add up to the totals quoted in the text.

Maps

- All maps in this report are used for illustrative purposes only. All locations are approximate. The sizes of map pins are not to scale.

Background

The Ontario government has been inviting investment in generation technologies and facilities to supply new generation capacity over the last decade. This additional electricity has been procured through fixed term contracts with suppliers for renewable energy, clean energy (natural gas and nuclear energy) and energy produced from municipal waste. The Ministry of Energy determines the procurement levels for each fuel type based on its Long-Term Energy Plan. The IESO administers each contract that has been executed under the specific procurements, programs or initiatives. The total amount of energy contracted by the IESO makes up a significant proportion of Ontario's electricity supply mix⁵. About half of Ontario's installed capacity is under contract to the IESO.

The purpose of this report is to provide details about the IESO's contracted supply capacity. The data in this report are limited to the capacities under contract to the IESO. The report does not include Ontario Power Generation (OPG) regulated assets,⁶ heritage assets, NUGs operating under contracts with the OEFC and market participants that sell energy on the open market and receive the hourly market price of electricity.

This report provides information about contracted capacities using the following dimensions:

1. timelines
2. connection type
3. fuel type
4. contract type
5. procurement type
6. geography.

Suppliers that have signed contracts with the IESO include, but are not limited to: private sector businesses, business partnerships, cooperatives, public sector organizations, municipal entities and governments, Aboriginal communities, community groups, school boards, farmers, and homeowners.

⁵ See the [IESO Current Supply Mix](#) for more information.

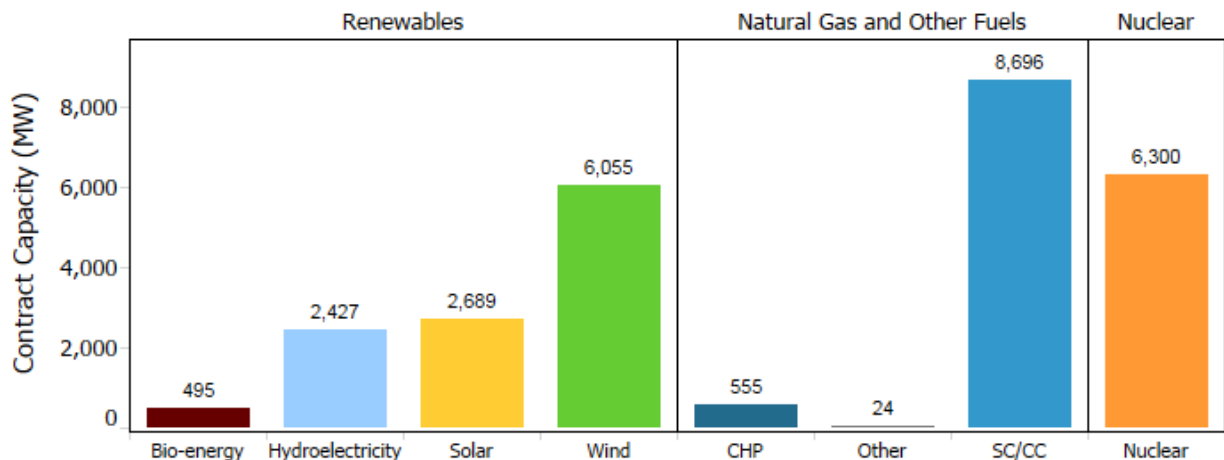
⁶ Some OPG assets are under contract to the IESO and are included in this report. These are: the Upper and Lower Mattagami facilities, Portlands Energy Centre, Brighton Beach Power Station, Atikokan Generating Station (GS), Healey Falls GS, Lac Seul GS, Lennox GS, and Thunder Bay GS (Unit 3). See the [OPG website](#) for more information.

The generation facilities for many contracts are constructed specifically for the purpose of producing energy under these contracts. Some facilities, such as some hydroelectric plants, are legacy facilities built many decades ago but have only recently entered into contracts with the IESO. A number of legacy facilities, such as hydroelectric and nuclear, undergo equipment upgrades, capacity expansions or refurbishment work to increase their generation capabilities. These incremental upgrades are reported as projects undergoing development. In programs, such as the Feed-in Tariff (FIT) Program and microFIT Program, existing structures (such as commercial buildings, farms and homes) have been retrofitted with technology to produce renewable energy.

Overview

This report summarizes the cumulative contract data for the fourth calendar quarter of 2016 ending December 31, 2016 and changes occurring within the third quarter. As at December 31, 2016, the IESO was managing 28,341 contracts, which have a combined capacity of 27,242 MW. This capacity was spread across eight fuel types⁷ and three fuel groups as shown in Figure 1. The total amount of contracted capacity in commercial operation was 23,993 MW, while 3,250 MW remained under development.

Figure 1: Total Contracted Capacity by Fuel Type



* 'Other' consists of Energy-from-Waste fuel

The total contracted capacity shown in Figure 1 can be subdivided into in-service capacity or in commercial operation (CO) capacity and capacity under development (UD). See Figure 2 below for a breakdown by operational status.

⁷ Many CHP facilities use natural gas as the fuel source. Because the heat that is generated by CHP facilities is used as a fuel source for heating or cooling buildings, CHP is categorized as a separate fuel type that represents cogeneration technology. Facilities, such as Lennox GS, that use both natural gas and oil as fuel are included under the SC/CC natural gas category.

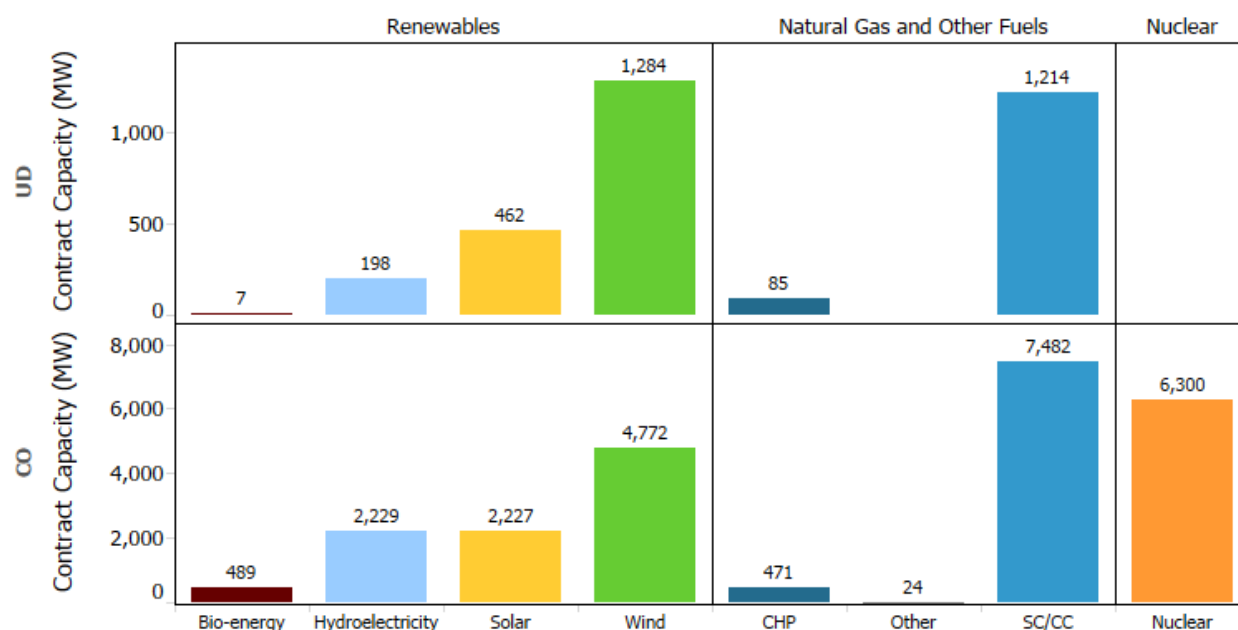
Figure 2: Total Contracted Capacity by Contract Status

Table 1 below provides a summary of the cumulative contracted capacity and numbers of contracts by fuel type and project status. Table 6 provides a more comprehensive breakdown of the summary data.

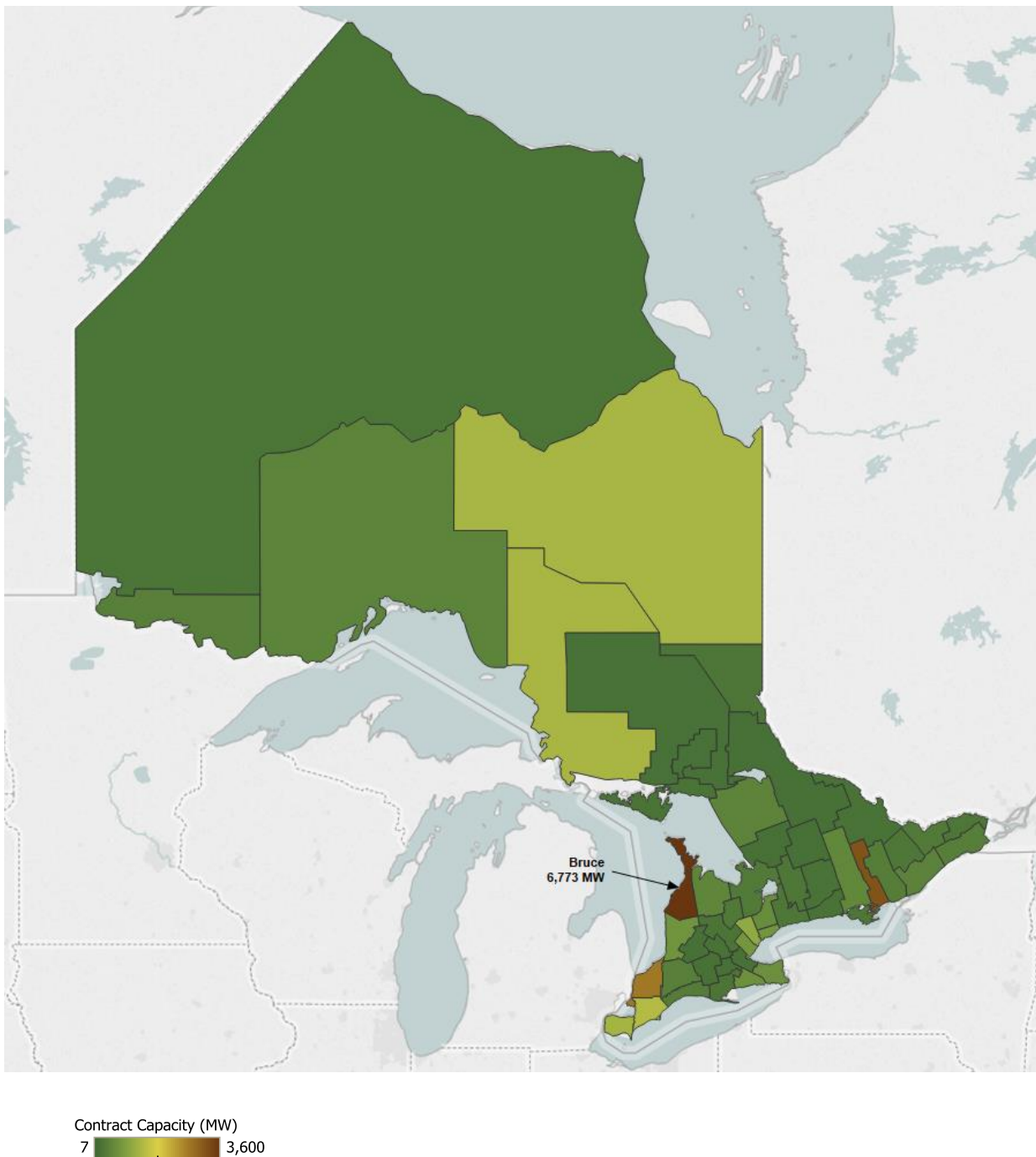
Table 1: Contracted Capacities by Fuel and Contract Status

Categories		UD			CO			Grand Total		
Fuel Group	Fuel Category	No. of Contracts	Total Capacity (MW)	% of Total Capacity	No. of Contracts	Total Capacity (MW)	% of Total Capacity	No. of Contracts	Total Capacity (MW)	% of Total Capacity
Renewables	Bio-energy	20	6.6	0.0%	66	488.7	1.8%	86	495.3	1.8%
	Hydroelectricity	40	198.1	0.7%	87	2,228.6	8.2%	122	2,426.7	8.9%
	Solar	815	462.3	1.7%	27,146	2,227.0	8.2%	27,961	2,689.4	9.9%
	Wind	21	1,283.7	4.7%	103	4,771.6	17.5%	124	6,055.3	22.2%
	Total	896	1,950.7	7.2%	27,402	9,716.0	35.7%	28,293	11,666.7	42.8%
Natural Gas and Other Fuels	CHP	14	84.8	0.3%	12	470.6	1.7%	26	555.4	2.0%
	SC/CC	2	1,214.0	4.5%	17	7,481.9	27.5%	19	8,695.9	31.9%
	Other				2	24.2	0.1%	2	24.2	0.1%
	Total	16	1,298.8	4.8%	31	7,976.7	29.3%	47	9,275.5	34.0%
Nuclear	Nuclear				1	6,300.0	23.1%	1	6,300.0	23.1%
	Total				1	6,300.0	23.1%	1	6,300.0	23.1%
Grand Total		912	3,249.5	11.9%	27,434	23,992.7	88.1%	28,341	27,242.2	100.0%

*Hydroelectric contracts: see "Assumptions and Caveats" regarding counting methodology for expansion projects

By 2020, the construction of most projects will be complete, and total in-service contracted capacities across Ontario are expected to be at their peak. Figure 3 below shows how the geographic distribution of total in-service contracted capacities would look like at this peak. In 2021, in-service contracted capacities will begin to decline from this peak as contracts expire.

Figure 3: Map of Total Contracted Capacity in Ontario



Changes to Contract Capacity (Oct. 1 to Dec. 31, 2016)

See Table 2 for a detailed account of the changes⁸ that occurred during the quarter. The main changes in contracted capacity and contract volumes to note are⁹:

1. Capacity Changes

- Total contracted capacity increased by 56 MW
- 280 MW of combined capacity were recognized as having achieved contractual commercial operation include:¹⁰
 - 21 MW of solar energy
 - 258 MW of wind energy

2. New Contracts

- The total number of contracts managed increased by 310 contracts (net of terminations) which includes:
 - 68 microFIT contracts
 - 244 FIT contracts

3. Large Facilities Achieving Contractual Commercial Operation¹¹

- Niagara Region Wind Farm - 230 MW (wind) located close to Smithville in the Regional Municipality of Niagara

Table 2 below illustrates the net changes in contract activity. The following types of changes are represented in the table:

- capacity reductions: no change in contract numbers and a negative capacity change
- capacity expansions: no change in contract numbers and a positive capacity change
- facilities under development that achieved commercial operation: a decrease in under-development capacity and number of contracts and an increase in-service capacity and number of contracts

⁸ Changes are net of: terminations, capacity amendments (reductions, upgrades and expansions) and new contracts.

⁹ Numbers are rounded and may not add up to the totals quoted in the text.

¹⁰ Facilities reported as having achieved in commercial operation have fulfilled their contractual obligations required to begin generation.

¹¹ Suppliers must register with the IESO if they are participating in the IESO-administered markets or programs, or if connecting a physical facility to the IESO-controlled grid. Market registration is a separate process from commissioning and in some cases may be completed after the contractual commercial operation date has occurred. See [Market Registration](#) for more information. Consult the [New and Retired Generation Since the IESO Market Opened in May 2002](#) list and the [18-Month Outlook – Section 2.2: Updates to Resources](#) to determine whether generators registered as Market Participants have completed the IESO market registration process. Bear in mind that the capacities of the facilities in these resources are installed capacities and may not be equal to the contract capacities cited in this report.

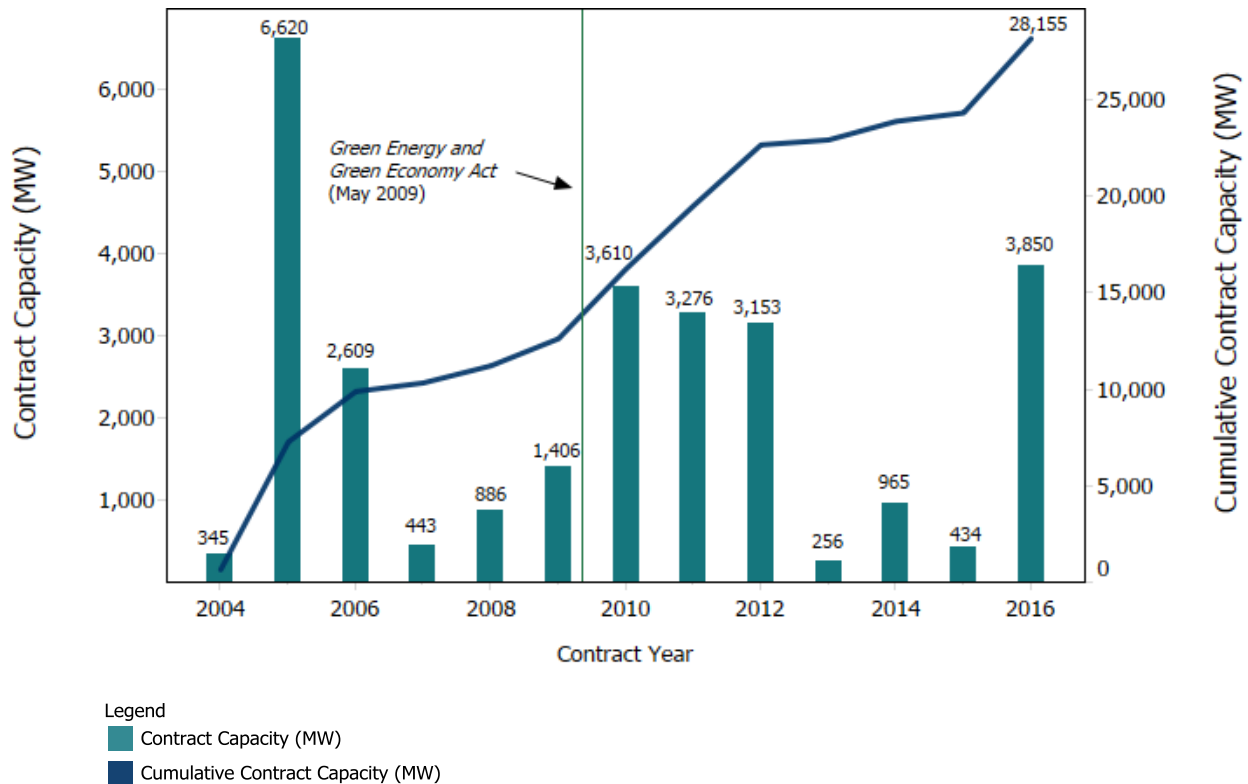
Table 2: Net Changes in Contract Volume from Oct. 1 to Dec. 31, 2016

Categories			Net Changes in the Number of Contracts			Net Changes in Contracted Capacity (MW)		
Fuel Group	Fuel Category	Contract Type	UD	CO	Total	UD	CO	Total
Renewables	Bio-energy	ABESA						
		CHP						
		FIT	3	1	4	0.9	0.3	1.1
		NUG						
		RES						
		RESOP						
		TBESA						
		Total	3	1	4	0.9	0.3	1.1
	Hydroelectricity	FIT	4		4	1.1		1.1
		HCI					0.0	0.0
		HESA						
		HESOP						
		LRP						
		RES						
		RESOP						
		Total	4		4	1.1		1.1
	Solar	FIT	92	140	232	36.6	20.6	57.2
		GEIA						
		LRP						
		microFIT		68	68		0.6	0.6
		RESOP						
		Total	92	208	300	36.6	21.2	57.8
	Wind	FIT	1	3	4	-267.5	258.0	-9.5
		GEIA						
		LRP						
		microFIT						
		RES						
RESOP								
Total	1	3	4	-267.5	258.0	-9.5		
Total			100	212	312	-228.9	279.5	50.5
Natural Gas and Other Fuels	CHP	CHP						
		CHPSOP	-2		-2	-19.9		-19.9
		NUG						
		Total	-2		-2	-19.9		-19.9
	SC/CC	ACES						
		CES				25.0		25.0
		EMCES						
		LESA						
		NUG						
		NYRP						
		Total				25.0		25.0
	Other	EFW						
		NUG						
Total								
Total			-2		-2	5.1		5.1
Nuclear	Nuclear	ABPRIA						
		Total						
	Total							
Grand Total			98	212	310	-223.8	279.5	55.6

Timelines – Historical and Projected

The first agreements for contracted capacity were executed in 2004. These procurements began with competitive offers and bi-lateral negotiations, and subsequently, standard offer programs were introduced. Figure 4 illustrates the cumulative amount of capacity procured since 2004 and the amount of capacity (gross) that were contracted annually.

Figure 4: Timeline of Contracts Executed



The timeline of programs and procurements executed as a result of ministerial directives includes:

- 2004 - RES I
- 2005 - BPRIA, ACES, RES II, EMCES
- 2006 - RESOP
- 2007 - HESA, RES III
- 2008 - CHP I
- 2009 - CHP III, HCI, FIT 1 and microFIT
- 2010 - ABESA, CHPSOP
- 2011 - microFIT, GEIA
- 2012 - FIT 2/microFIT program review

- 2013 - HESOP, NUG
- 2014 - TBESA, FIT 3
- 2016 – ABPRIA, LRP I, FIT 4.

The average term of an IESO contract is about 20 years. The range of contract terms is from five years to 50 years; however, pilot projects usually start with a term of two years. The general ranges of contract terms according to fuel types are:

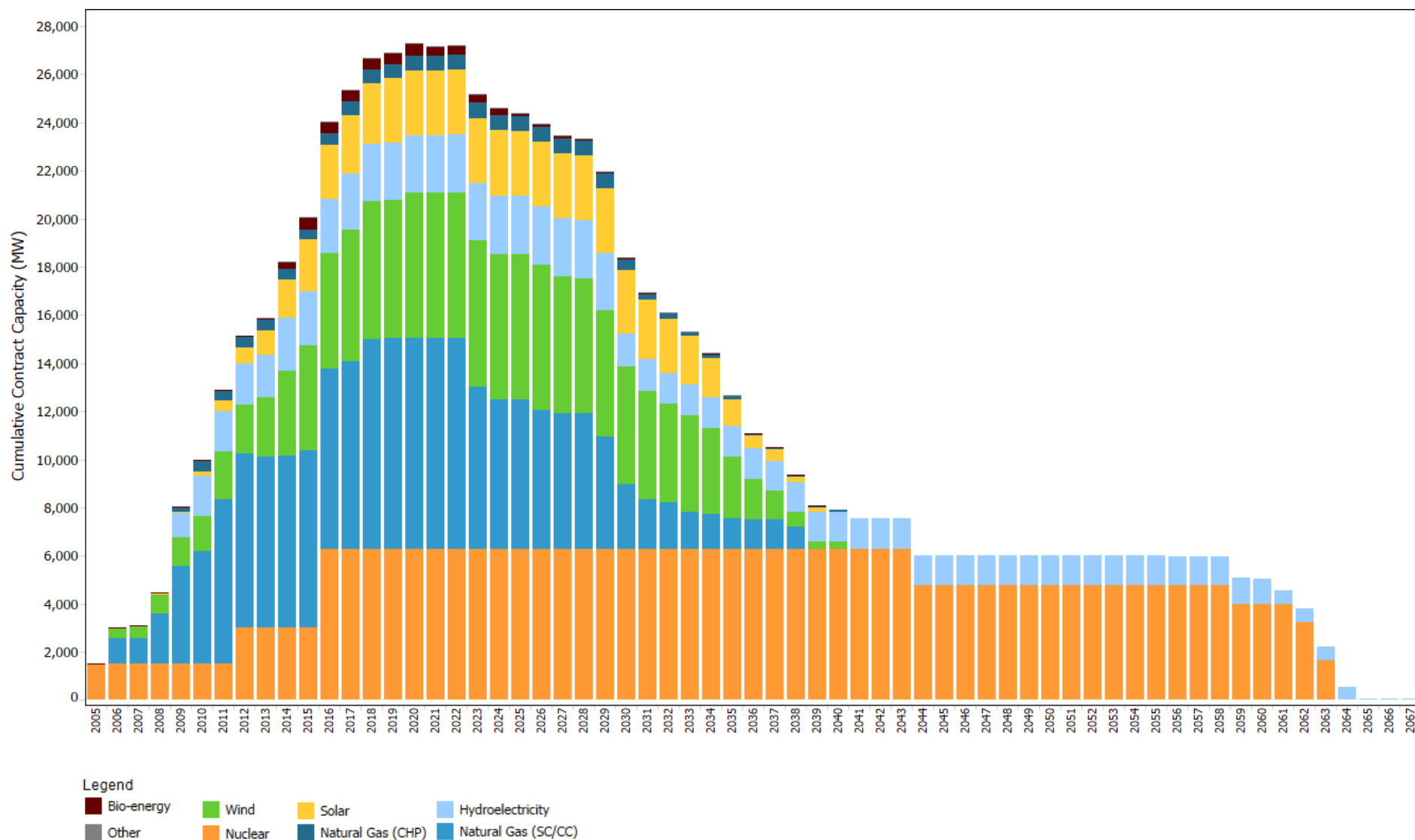
- bio-energy: five to 21 years
- energy from waste: 20 years
- hydroelectricity: 20 to 50 years
- natural gas: 10 to 20 years
- nuclear: 31 to 57 years (amended)
- solar: 20 years
- wind: 20 years

Figure 5 illustrates the projected lifecycle of total contract capacities by applying the contract term lengths to the actual commercial operation dates and expected MCODs of the facilities.¹² The resulting graph shows how contracted capacity is expected to increase and decrease over the life of the contracts as facilities achieve commercial operation and contracts expire at the end of the term.¹³

¹² Where the MCOD has passed and the project is not in commercial operation, the estimated commercial operation date is considered as being in the current year (for estimation purposes only).

¹³ Annual capacity amounts are not prorated for years when the in-service capacity is only for a partial year.

Figure 5: Projected Lifecycle for Contracted Capacity



Capacity by Grid Connection

This section summarizes the connection configuration of contracted generating facilities to the electrical grid. Contracted generating facilities are either:

1. connected directly to the IESO-administered transmission grid (Tx)¹⁴
2. embedded within the distribution network of local distribution companies (Dx).¹⁵

Embedded generators supply electricity to local distribution systems, helping to offset demand on the grid by supporting some of the needs of local communities.

Generally, large capacity projects are connected to transmission grid and are dispatched by the IESO. Smaller capacity projects are usually connected to distribution networks. However, there are exceptions to both of these rules.

Table 3: Connection Type by Fuel

Categories		UD			CO			Grand Total		
Connection	Fuel Category	No. of Contracts	Total Capacity (MW)	% of Total Capacity	No. of Contracts	Total Capacity (MW)	% of Total Capacity	No. of Contracts	Total Capacity (MW)	% of Total Capacity
Dx	Bio-energy	20	6.6	0.0%	63	108.7	0.4%	83	115.3	0.4%
	CHP	14	84.8	0.3%	10	150.2	0.6%	24	235.0	0.9%
	Hydroelectricity	29	77.5	0.3%	78	238.2	0.9%	105	315.6	1.2%
	Other				2	24.2	0.1%	2	24.2	0.1%
	SC/CC				4	108.4	0.4%	4	108.4	0.4%
	Solar	811	264.3	1.0%	27,136	1,947.0	7.1%	27,947	2,211.4	8.1%
	Wind	10	49.2	0.2%	62	561.8	2.1%	72	611.0	2.2%
	Total	884	482.4	1.8%	27,355	3,138.5	11.5%	28,237	3,620.9	13.3%
Tx	Bio-energy				3	380.0	1.4%	3	380.0	1.4%
	CHP				2	320.4	1.2%	2	320.4	1.2%
	Hydroelectricity	11	120.6	0.4%	9	1,990.5	7.3%	17	2,111.1	7.7%
	Nuclear				1	6,300.0	23.1%	1	6,300.0	23.1%
	SC/CC	2	1,214.0	4.5%	13	7,373.5	27.1%	15	8,587.5	31.5%
	Solar	4	198.0	0.7%	10	280.0	1.0%	14	478.0	1.8%
	Wind	11	1,234.5	4.5%	41	4,209.8	15.5%	52	5,444.3	20.0%
	Total	28	2,767.1	10.2%	79	20,854.2	76.6%	104	23,621.3	86.7%
Grand Total		912	3,249.5	11.9%	27,434	23,992.7	88.1%	28,341	27,242.2	100.0%

¹⁴ All assets, regardless of size, that are connected to the transmission grid are included in transmission data.

¹⁵ The embedded contracted capacity shown here are not included in the IESO supply mix data estimate unless the supplier participates in the IESO-administered market. See [Transmission-Connected Generation](#).

Table 4: Connection Type by Contract Type

Categories		UD		CO		Grand Total	
Connection	Contract Type	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)
Dx	CES			1	90.0	1	90.0
	CHP			6	101.6	6	101.6
	CHPSOP	14	84.8	4	10.9	18	95.7
	EFW			1	13.9	1	13.9
	EMCES			3	18.4	3	18.4
	FIT	856	295.1	2,530	1,613.8	3,386	1,908.9
	HCI	2	8.5	49	101.0	49	109.5
	HESA			2	59.7	2	59.7
	HESOP	3	36.6	4	7.7	7	44.3
	LRP	9	57.4			9	57.4
	microFIT			24,622	216.8	24,622	216.8
	NUG			3	61.0	3	61.0
	RES			4	17.3	4	17.3
	RESOP			126	826.5	126	826.5
	Total	884	482.4	27,355	3,138.5	28,237	3,620.9
Tx	ABESA			1	205.0	1	205.0
	ABPRIA			1	6,300.0	1	6,300.0
	ACES			3	2,030.6	3	2,030.6
	CES	2	1,214.0	2	1,582.0	4	2,796.0
	CHP			3	360.4	3	360.4
	EMCES			2	985.3	2	985.3
	FIT	10	775.0	32	1,930.7	42	2,705.7
	GEIA	4	300.0	6	1,068.6	10	1,368.6
	HCI	2	11.5	4	997.6	4	1,009.1
	HESA	2	53.1	2	951.0	3	1,004.1
	LESA			1	2,000.0	1	2,000.0
	LRP	7	397.5			7	397.5
	NUG			4	382.7	4	382.7
	NYRP			1	393.0	1	393.0
	RES	1	16.0	16	1,532.4	17	1,548.4
	TBESA			1	135.0	1	135.0
	Total	28	2,767.1	79	20,854.2	104	23,621.3
Grand Total		912	3,249.5	27,434	23,992.7	28,341	27,242.2

Capacity by Procurement Method

The procurement methodologies used to acquire contracted capacities are standard offer, bi-lateral negotiations or competitive bids. Table 5 provides a summary of the current total capacities contracted by the different procurement methods.

Table 5: Capacities by Procurement

Categories		UD		CO		Grand Total	
Procurement Type	Fuel Category	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)
Bi-lateral Negotiation	Bio-energy			3	345.0	3	345.0
	CHP			1	45.7	1	45.7
	Hydroelectricity	3	62.8	6	1,982.9	7	2,045.7
	Nuclear			1	6,300.0	1	6,300.0
	Other			1	10.3	1	10.3
	SC/CC			12	4,775.4	12	4,775.4
	Solar	2	100.0	2	200.0	4	300.0
	Wind	2	200.0	4	868.6	6	1,068.6
	Total	7	362.8	30	14,527.9	35	14,890.7
Competitive	Bio-energy			5	57.3	5	57.3
	CHP	14	84.8	11	424.9	25	509.7
	Hydroelectricity	5	31.5	2	31.0	7	62.5
	Other			1	13.9	1	13.9
	SC/CC	2	1,214.0	5	2,706.5	7	3,920.5
	Solar	7	139.9			7	139.9
	Wind	5	299.5	15	1,509.4	20	1,808.9
	Total	33	1,769.7	39	4,743.0	72	6,512.7
Standard Offer	Bio-energy	20	6.6	58	86.4	78	93.0
	Hydroelectricity	32	103.8	79	214.8	108	318.5
	Solar	806	222.4	27,144	2,027.0	27,950	2,249.5
	Wind	14	784.2	84	2,393.6	98	3,177.8
	Total	872	1,117.0	27,365	4,721.8	28,234	5,838.8
Grand Total		912	3,249.5	27,434	23,992.7	28,341	27,242.2

IESO Contracts and Contract Capacity

Table 6: Number of Contracts and Contract Capacity

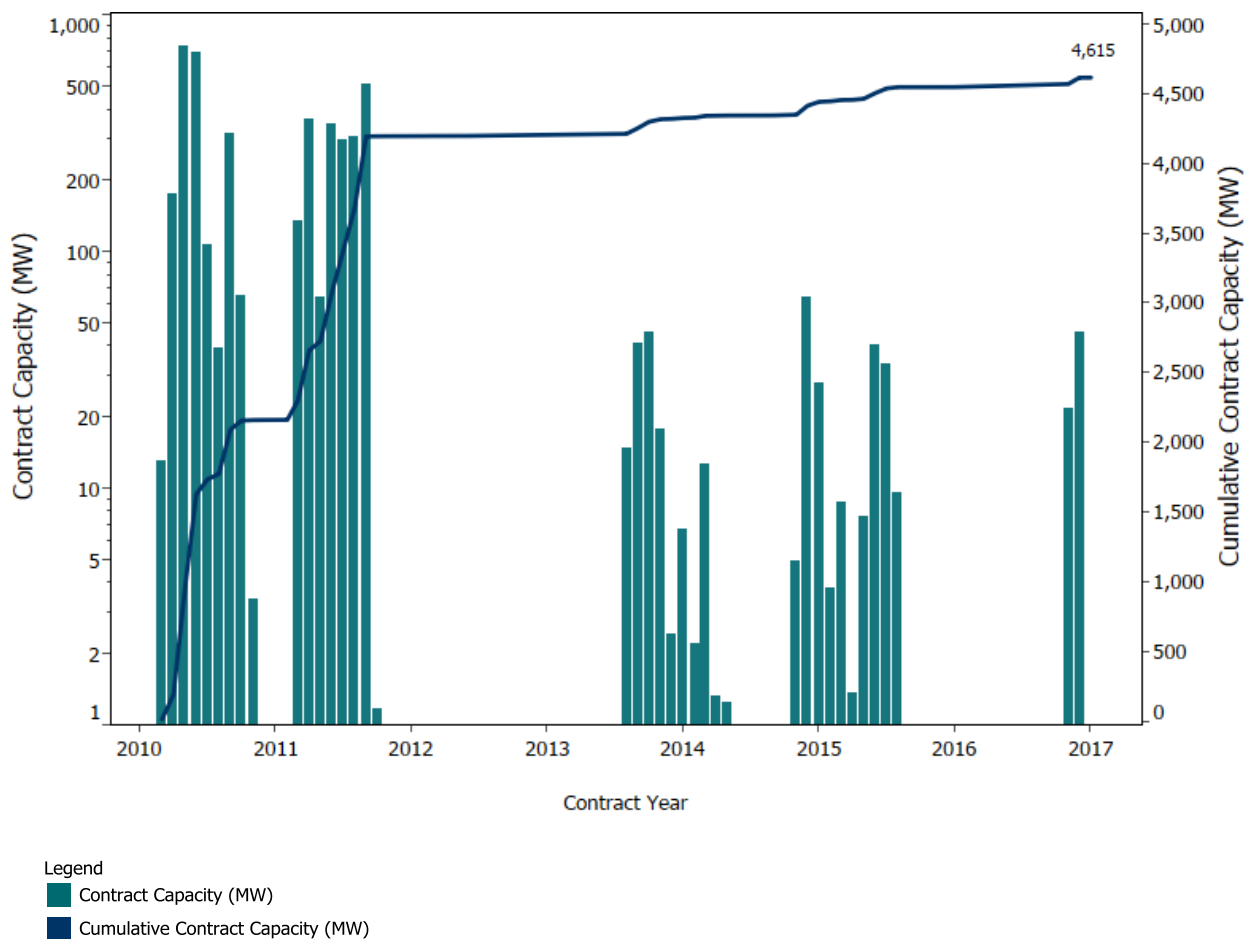
Categories			No. of Contracts		Total Capacity (MW)		% of Total Capacity		No. of Contracts	Total Capacity (MW)	% of Total Capacity
Fuel Group	Fuel Category	Contract Type	UD	CO	UD	CO	UD	CO	Total	Total	Total
Renewables	Bio-energy	ABESA		1		205.0		0.8%	1	205.0	0.8%
		CHP		2		48.0		0.2%	2	48.0	0.2%
		FIT	20	40	6.6	46.7	0.02%	0.2%	60	53.3	0.2%
		NUG		1		5.0		0.02%	1	5.0	0.02%
		RES		3		9.3		0.03%	3	9.3	0.03%
		RESOP		18		39.7		0.1%	18	39.7	0.1%
		TBESA		1		135.0		0.5%	1	135.0	0.5%
	Total	20	66	6.6	488.7	0.02%	1.8%	86	495.3	1.8%	
	Hydroelectricity	FIT	26	8	56.9	52.5	0.2%	0.2%	34	109.4	0.4%
		HCI	4	53	20.0	1,098.5	0.1%	4.0%	53	1,118.5	4.1%
		HESA	2	4	53.1	1,010.7	0.2%	3.7%	5	1,063.8	3.9%
		HESOP	3	4	36.6	7.7	0.1%	0.03%	7	44.3	0.2%
		LRP	4		15.5		0.1%		4	15.5	0.1%
		RES	1	2	16.0	31.0	0.1%	0.1%	3	47.0	0.2%
		RESOP		16		28.2		0.1%	16	28.2	0.1%
	Total	40	87	198.1	2,228.6	0.7%	8.2%	122	2,426.7	8.9%	
	Solar	FIT	806	2,469	222.4	1,336.6	0.8%	4.9%	3,275	1,559.0	5.7%
		GEIA	2	2	100.0	200.0	0.4%	0.7%	4	300.0	1.1%
		LRP	7		139.9		0.5%		7	139.9	0.5%
		microFIT		24,618		216.8		0.8%	24,618	216.8	0.8%
		RESOP		57		473.7		1.7%	57	473.7	1.7%
		Total	815	27,146	462.3	2,227.0	1.7%	8.2%	27,961	2,689.4	9.9%
	Wind	FIT	14	45	784.2	2,108.7	2.9%	7.7%	59	2,892.9	10.6%
		GEIA	2	4	200.0	868.6	0.7%	3.2%	6	1,068.6	3.9%
		LRP	5		299.5		1.1%		5	299.5	1.1%
		microFIT		4		0.0		0.00%	4	0.0	0.00%
		RES		15		1,509.4		5.5%	15	1,509.4	5.5%
		RESOP		35		284.9		1.0%	35	284.9	1.0%
Total		21	103	1,283.7	4,771.6	4.7%	17.5%	124	6,055.3	22.2%	
Total			896	27,402	1,950.7	9,716.0	7.2%	35.7%	28,293	11,666.7	42.8%
Natural Gas and Other Fuels	CHP	CHP		7		414.0		1.5%	7	414.0	1.5%
		CHPSOP	14	4	84.8	10.9	0.3%	0.04%	18	95.7	0.4%
		NUG		1		45.7		0.2%	1	45.7	0.2%
		Total	14	12	84.8	470.6	0.3%	1.7%	26	555.4	2.0%
	SC/CC	ACES		3		2,030.6		7.5%	3	2,030.6	7.5%
		CES	2	3	1,214.0	1,672.0	4.5%	6.1%	5	2,886.0	10.6%
		EMCES		5		1,003.6		3.7%	5	1,003.6	3.7%
		LESA		1		2,000.0		7.3%	1	2,000.0	7.3%
		NUG		4		382.7		1.4%	4	382.7	1.4%
		NYRP		1		393.0		1.4%	1	393.0	1.4%
		Total	2	17	1,214.0	7,481.9	4.5%	27.5%	19	8,695.9	31.9%
	Other	EFW		1		13.9		0.1%	1	13.9	0.1%
		NUG		1		10.3		0.04%	1	10.3	0.04%
Total			2		24.2		0.1%	2	24.2	0.1%	
Total			16	31	1,298.8	7,976.7	4.8%	29.3%	47	9,275.5	34.0%
Nuclear	Nuclear	ABPRIA		1		6,300.0		23.1%	1	6,300.0	23.1%
		Total		1		6,300.0		23.1%	1	6,300.0	23.1%
	Total			1		6,300.0		23.1%	1	6,300.0	23.1%
Grand Total			912	27,434	3,249.5	23,992.7	11.9%	88.1%	28,341	27,242.2	100.0%

Feed-in Tariff (FIT) Program

The FIT Program was launched in 2009 with the enactment of the Ontario government's *Green Energy and Green Economy Act*. FIT projects have capacities of more than 10 kilowatts. All FIT contracts are for renewable energy only, with the majority of contracts being for solar power.

Contracted capacity under the FIT Program has grown from 13 MW in March 2010 to 4,615 MW in the current reporting period. Figure 6 shows the capacity signed to the FIT Program since its inception.¹⁶

Figure 6: FIT Procurements by Year



¹⁶ The gap and low volume between the periods 2012 to 2013 corresponds to the FIT Program review.

Pre-NTP and NTP are stages in the development of a FIT project. Once a FIT contract is executed, it passes through the following stages:

1. The Pre-NTP stage:
 - regulatory approvals (if required)
 - system/customer impact assessments
 - domestic content plan approval (if required)
 - financing plan approvals.
2. The NTP Stage
 - notice to proceed with construction.

FIT Program Size Division

Table 7 summarizes FIT data by the capacity of the generating facility. FIT contracts can be divided into the following two categories:

- Small FIT – less than or equal to 0.5 MW
- Large FIT – greater than 0.5 MW

Table 7: FIT Size Division: Small FIT vs. Large FIT

Categories		Number of Contracts		Total Capacity (MW)		% Contract Capacity		Number of Contracts	Total Capacity (MW)	% Contract Capacity
FIT Size Class	Fuel Category	UD	CO	UD	CO	UD	CO	Total	Total	Total
Small FIT	Bio-energy	20	33	6.6	11.2	0.1%	0.2%	53	17.8	0.4%
	Hydroelectricity	13		3.2		0.1%		13	3.2	0.1%
	Solar	806	2,367	222.4	419.4	4.8%	9.1%	3,173	641.8	13.9%
	Wind	6	1	2.6	0.5	0.1%	0.0%	7	3.1	0.1%
	Total	845	2,401	234.8	431.1	5.1%	9.3%	3,246	665.9	14.4%
Large FIT	Bio-energy		7		35.5		0.8%	7	35.5	0.8%
	Hydroelectricity	13	8	53.7	52.5	1.2%	1.1%	21	106.2	2.3%
	Solar		102		917.2		19.9%	102	917.2	19.9%
	Wind	8	44	781.7	2,108.2	16.9%	45.7%	52	2,889.9	62.6%
	Total	21	161	835.3	3,113.3	18.1%	67.5%	182	3,948.6	85.6%
Grand Total		866	2,562	1,070.1	3,544.5	23.2%	76.8%	3,428	4,614.6	100.0%

Table 8 further summarizes the FIT Program based on the procurement stream (FIT 1, FIT 2, and FIT 3 and FIT 4), fuel type and stage in the FIT project development process.

Table 8: FIT Contracts by Program Stream

Categories		UD						CO		Grand Total	
Contract Type	Fuel Category	Pre-NTP		NTP		Total		Number of Contracts	Total Capacity (MW)	Number of Contracts	Total Capacity (MW)
		Number of Contracts	Total Capacity (MW)	Number of Contracts	Total Capacity (MW)	Number of Contracts	Total Capacity (MW)				
FIT 1	Bio-energy							35	45.1	35	45.1
	Hydroelectricity	16	39.1	4	16.5	20	55.6	8	52.5	28	108.1
	Solar							1,398	1,153.3	1,398	1,153.3
	Wind	5	753.4	3	28.3	8	781.7	45	2,108.7	53	2,890.4
	Total	21	792.5	7	44.7	28	837.2	1,486	3,359.6	1,514	4,196.8
FIT 2	Bio-energy	6	2.0	1	0.5	7	2.5	5	1.6	12	4.1
	Hydroelectricity	1	0.1			1	0.1			1	0.1
	Solar	9	2.5	26	4.9	35	7.4	832	135.3	867	142.6
	Total	16	4.6	27	5.4	43	10.0	837	136.9	880	146.9
FIT 3	Bio-energy	9	3.0			9	3.0			9	3.0
	Hydroelectricity	1	0.1			1	0.1			1	0.1
	Solar	246	81.2	267	70.8	513	152.0	239	48.0	752	200.0
	Wind	1	0.1			1	0.1			1	0.1
	Total	257	84.3	267	70.8	524	155.1	239	48.0	763	203.1
FIT 4	Bio-energy	4	1.1			4	1.1			4	1.1
	Hydroelectricity	4	1.1			4	1.1			4	1.1
	Solar	258	63.1			258	63.1			258	63.1
	Wind	5	2.5			5	2.5			5	2.5
	Total	271	67.8			271	67.8			271	67.8
Grand Total		565	949.3	301	120.8	866	1,070.1	2,562	3,544.5	3,428	4,614.6

Figure 7: FIT Contracts by Fuel Category, Fuel Sub-type and Contract Status

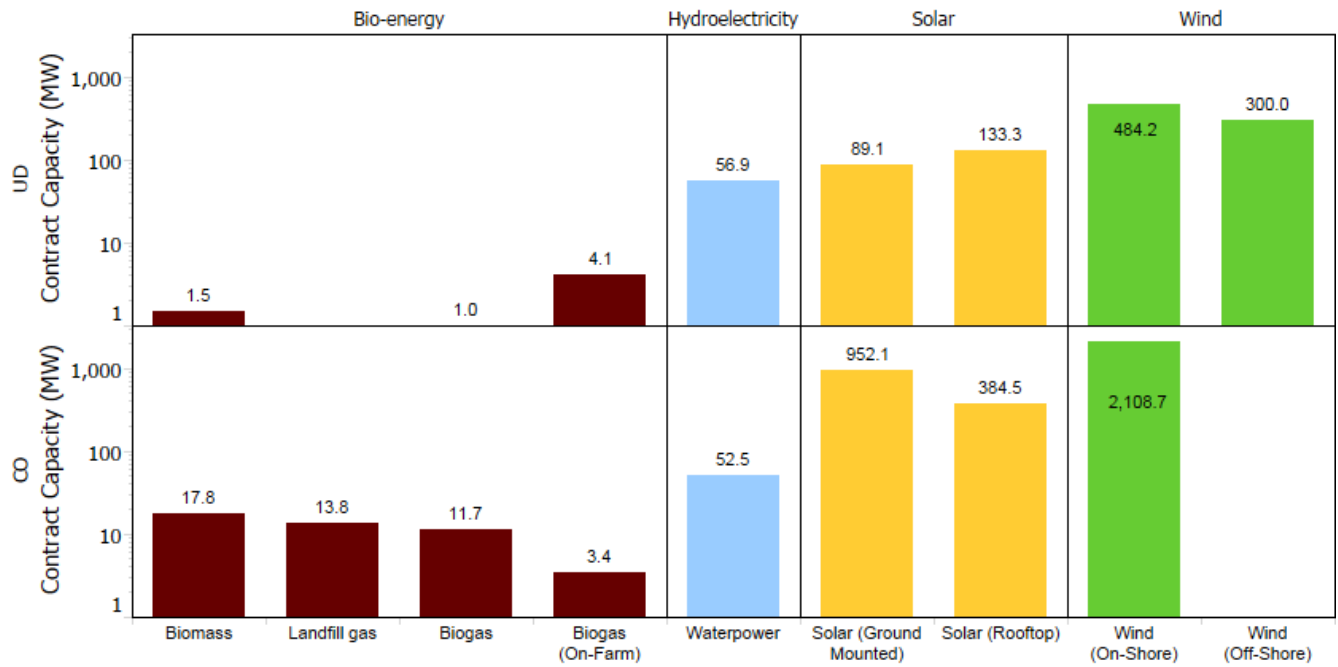
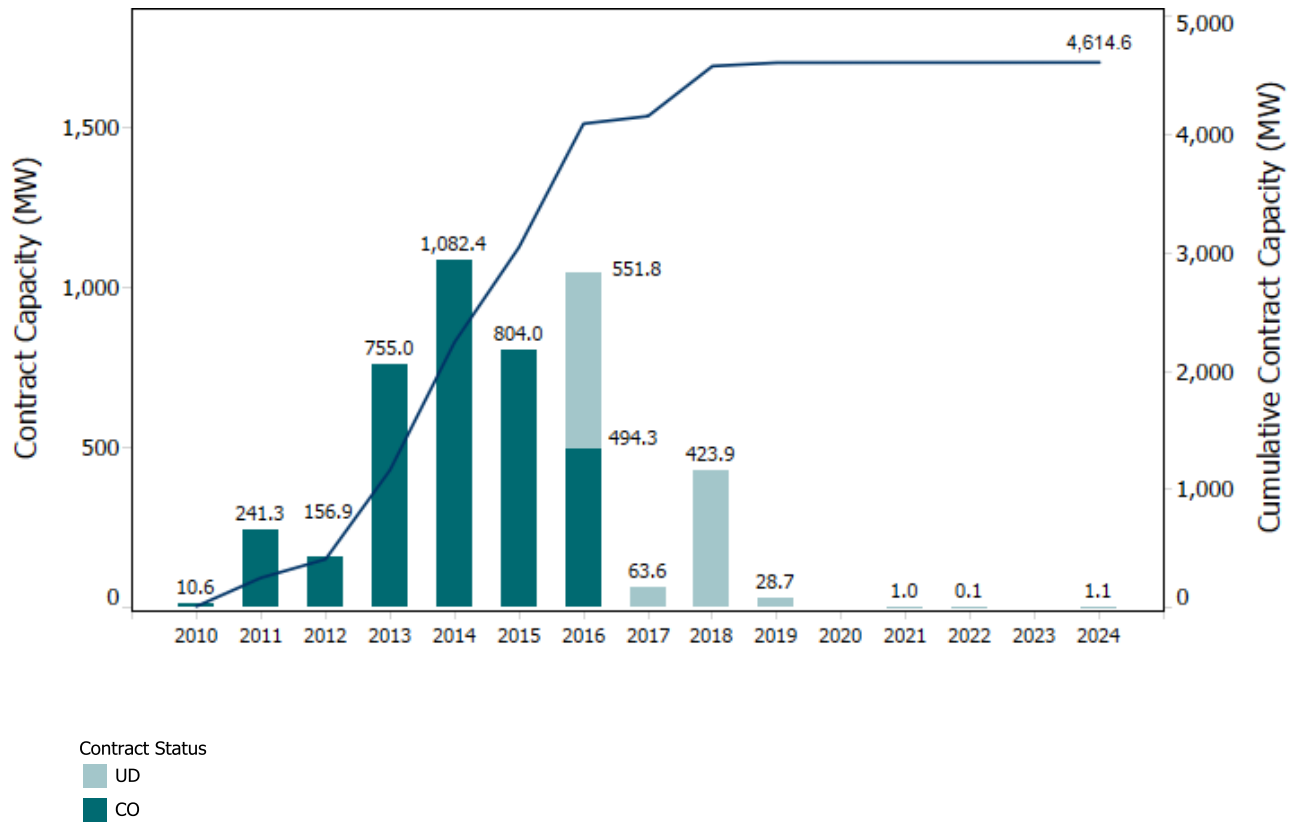


Figure 8 illustrates the timeline for installed FIT capacity and the projected implementation schedule by year. The graph displays:

- capacity that is already in commercial operation
- capacity that is currently under development.¹⁷

¹⁷ Where facilities are under development, but the MCOD of the contract has passed, the capacity is brought forward into the current year (for estimation purposes only).

Figure 8: Incremental and Cumulative FIT Capacity: In-Service and Scheduled



FIT Program Equity Participation Projects

Aboriginal Participation Projects

Under the rules of the FIT Program, contract-holders receive price adders if projects have Aboriginal equity participation. Table 9 below provides a summary of Aboriginal participation projects by fuel type and contract status. The map in Figure 9 shows the approximate locations of these projects.

Table 9: Aboriginal Participation

Categories		UD		CO		Grand Total	
Contract Type	Fuel Category	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)
FIT 1	Hydroelectricity	5	29.0	6	45.4	11	74.4
	Solar			8	70.0	8	70.0
	Wind	1	300.0	9	527.3	10	827.3
FIT 2	Solar	7	2.3	151	31.9	158	34.1
FIT 3	Solar	246	59.4	92	18.6	338	78.1
FIT 4	Solar	1	0.5			1	0.5
Grand Total		260	391.2	266	693.2	526	1,084.4

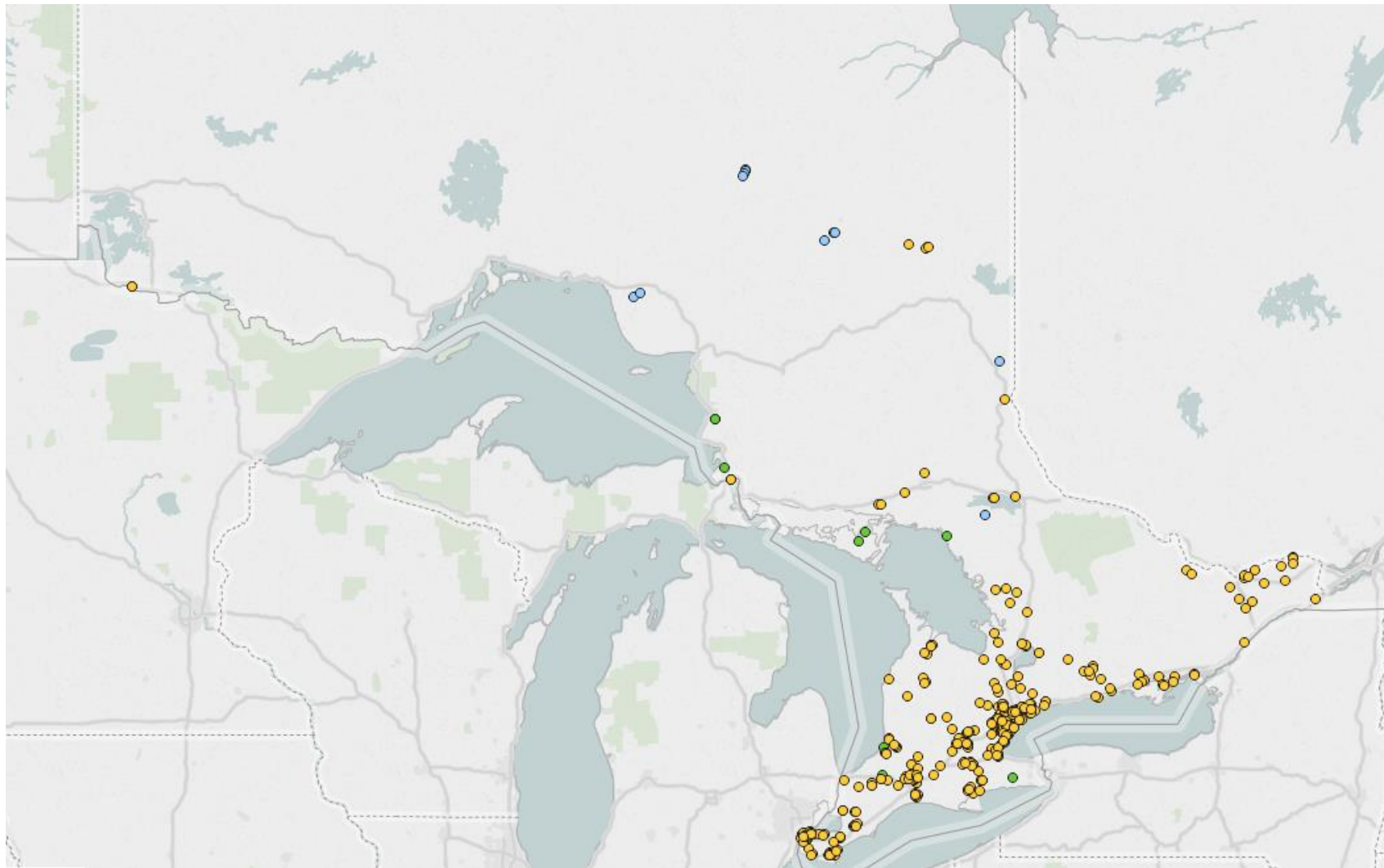
Community Participation FIT Projects

FIT Program contract holders receive price adders if projects have community equity participation. Table 10 provides a summary of community participation projects by fuel type and contract status. The map in Figure 10 shows the approximate locations of these projects.

Table 10: Community Participation

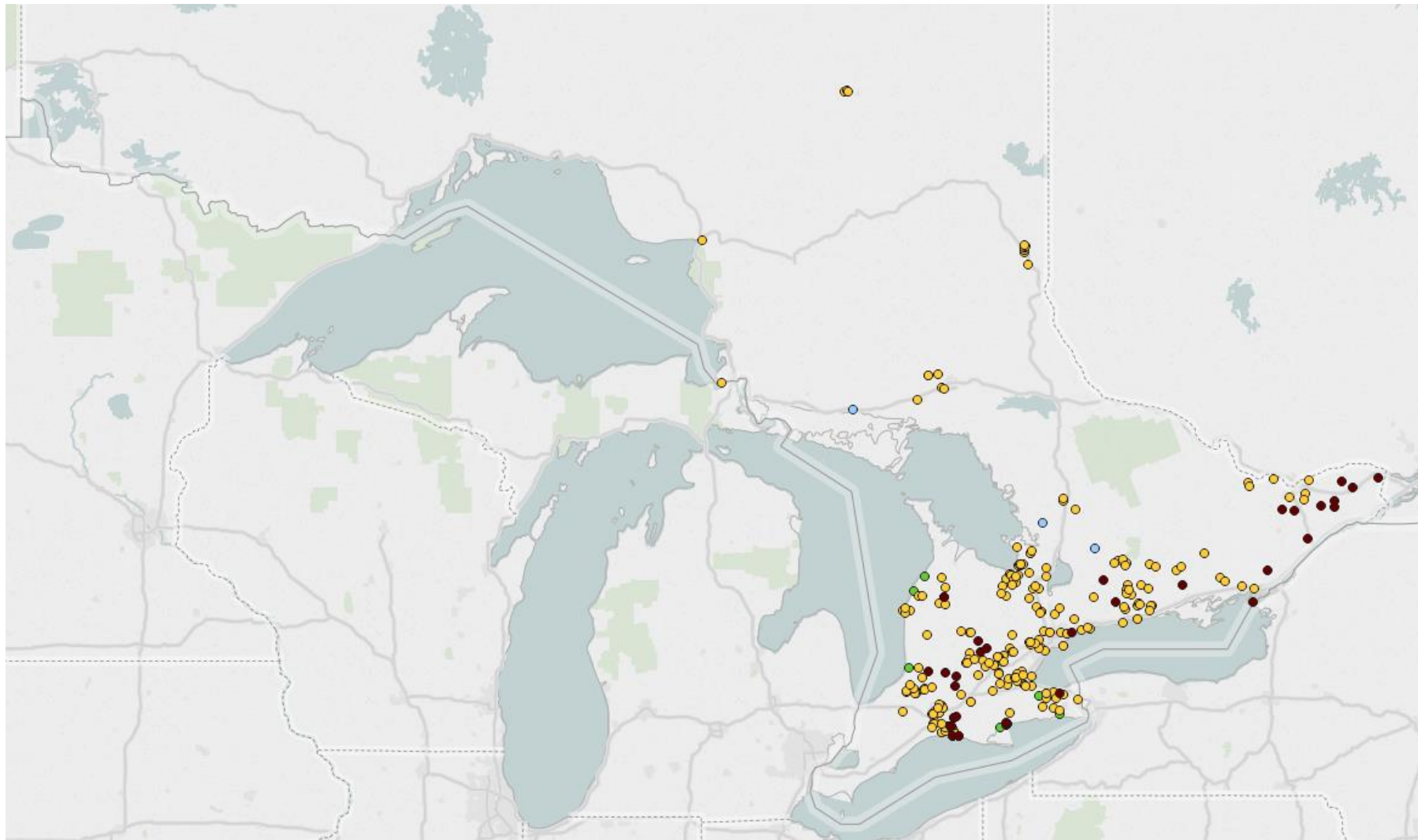
Fuel Category	UD		CO		Grand Total	
	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)	No. of Contracts	Total Capacity (MW)
Bio-energy	11	4.0	24	11.1	35	15.1
Hydroelectricity	3	6.5			3	6.5
Solar	122	41.1	175	34.4	297	75.6
Wind	2	10.5	6	33.6	8	44.1
Grand Total	138	62.2	205	79.2	343	141.3

Figure 9: Map of FIT Aboriginal Participation Projects



Fuel Type
■ Hydroelectricity
■ Solar
■ Wind

Figure 10: Map of FIT Community Participation Projects



Fuel Type
■ Bio-energy
■ Hydroelectricity
■ Solar
■ Wind

Large Renewable Procurement (LRP) Program

On June 12, 2013, the Minister of Energy directed the IESO to end the procurement of large projects greater than 500 kW under the FIT program and replace it with a new competitive bidding process. As a result, the Large Renewable Procurement (LRP) program was created for renewable energy projects using on-shore wind, solar PV, bio-energy and waterpower. The LRP program has been designed to provide municipalities with a stronger voice and additional opportunities to participate in the development of renewable energy projects. The LRP program was launched in April 2016 with the execution of 454.9 MW in renewable energy contracts. As a competitive procurement program, LRP is also designed to encourage cost-efficient renewable energy projects to provide value for ratepayers. See Table 6 for more information on LRP.

microFIT Program

The micro Feed-in Tariff Program (microFIT) was launched in 2009 at the same time as the FIT Program. It is an ongoing program, and each month the number of contracts and capacity in the program increases. microFIT projects have contracted capacities of 10 kilowatts or less. All microFIT contracts are for renewable energy. Contracts for microFIT projects are offered only after the projects have been built and are ready to go into commercial operation. Table 11 below shows that virtually all microFIT contracts are either ground-mounted or rooftop-mounted solar mounted projects.

The number of contracts executed annually has varied and there have been different contract prices offered for contract versions. Figure 11 below illustrates the number of microFIT contracts that were executed at each price level along with the growth in microFIT capacity. Figure 12 illustrates the geographic distribution of microFIT contracts throughout Ontario.

Table 11: Number of microFIT Contracts and Capacity by Fuel Type

Fuel Category	No. of Contracts	Contract Capacity (MW)
Solar	24,618	216.8
Wind	4	0.02
Grand Total	24,622	216.82

Figure 11: Number of microFIT Contracts by Price and Capacity Growth

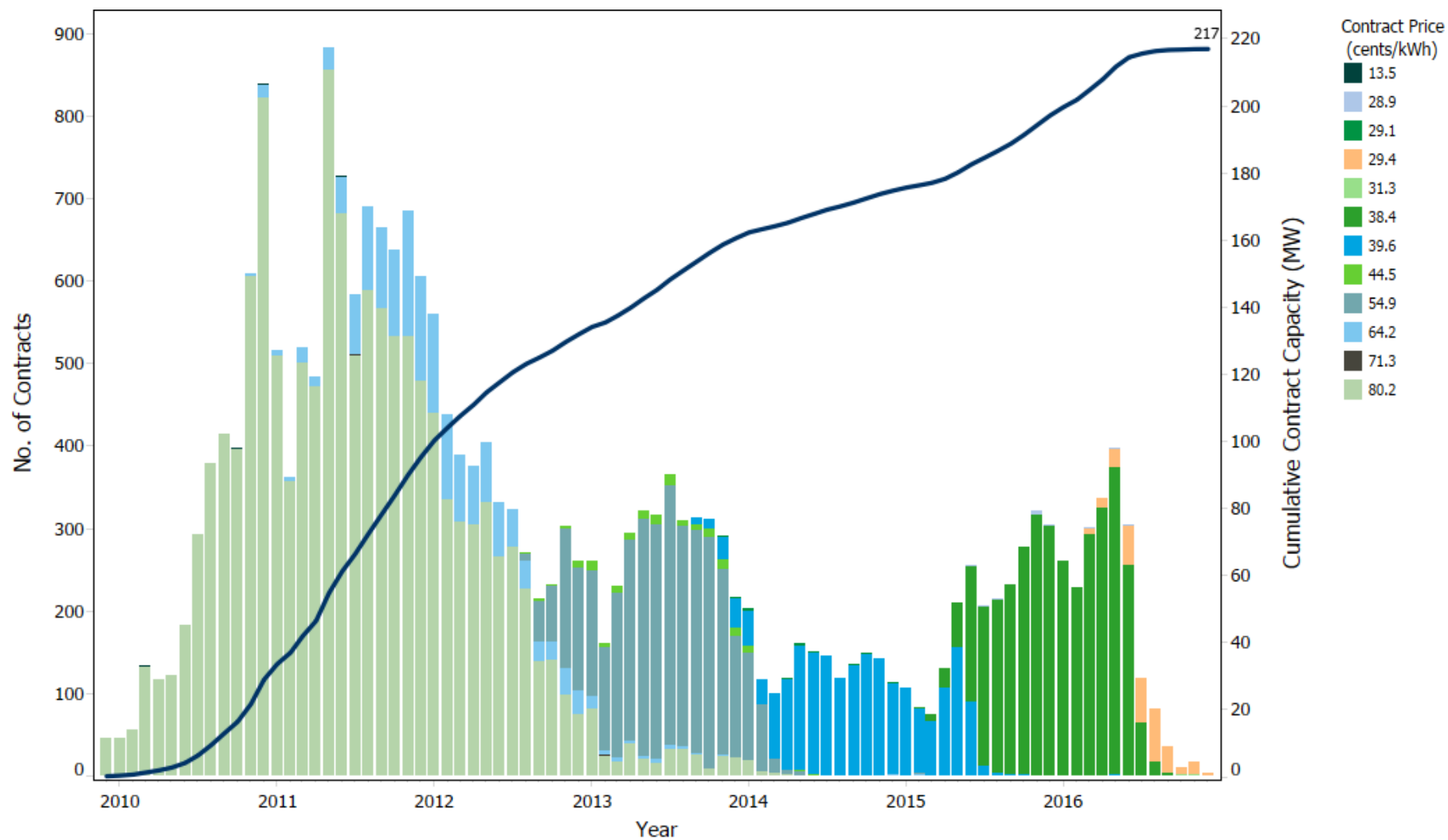


Figure 12: Map of microFIT Contracted Capacities in Ontario

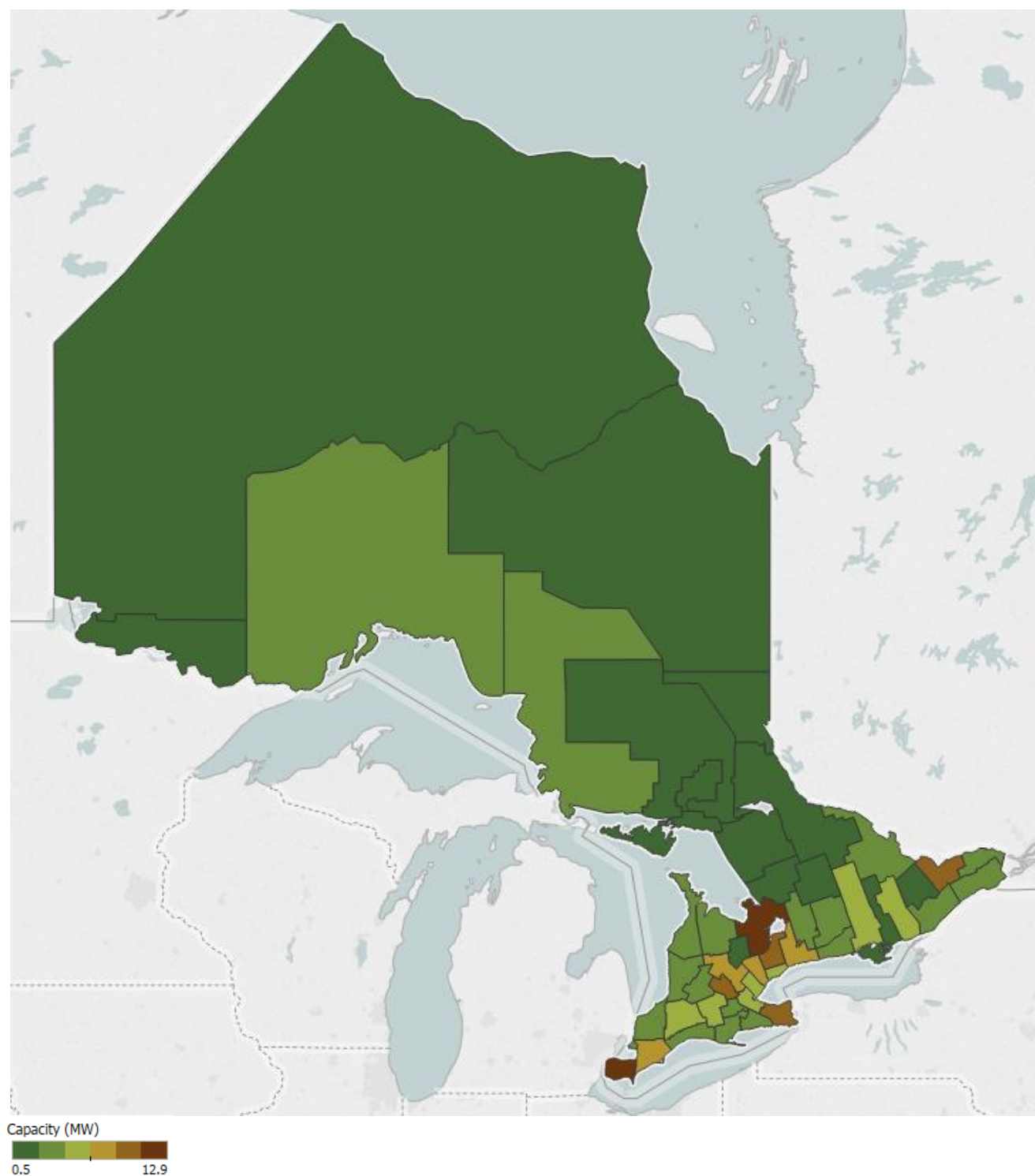
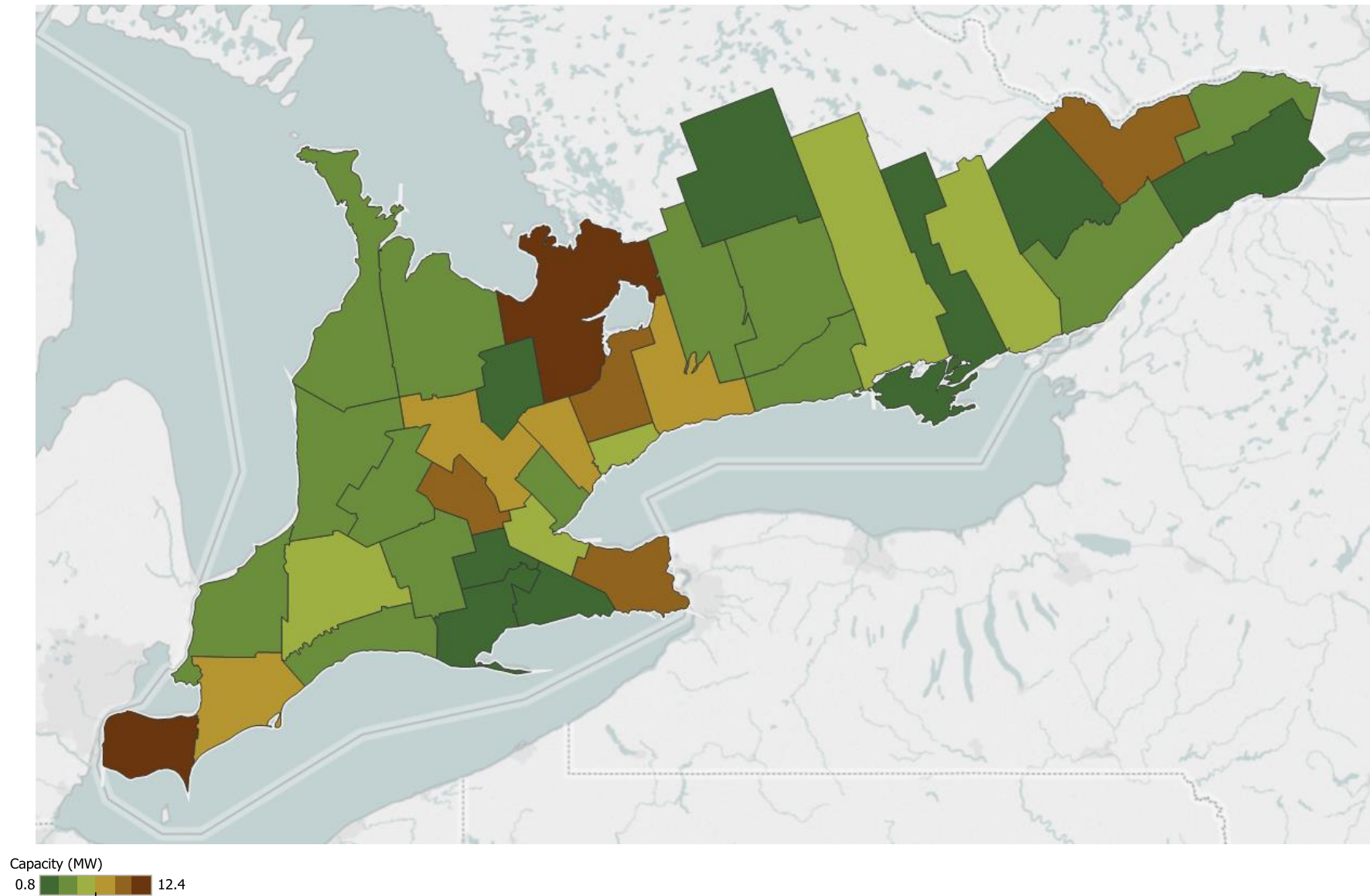


Figure 13: microFIT Contracted Capacities in Southern Ontario



Non-Renewable Fuel

This section provides a synopsis of the fuel types including clean energy (natural gas and nuclear energy) and energy from waste. The charts below illustrate the contract capacities added each year as well as the total growth in capacity for the particular fuel type. Figure 16 maps the approximate location of facilities that run on non-renewable fuel.

Natural Gas

IESO-contracted natural gas capacity is categorized into two groups based on technology:

1. simple and combined cycle (SC/CC)
2. cogeneration or combined heat and power (CHP).

Please refer to Table 1 and Table 6 for details on natural gas and other fuel capacity. Figure 14 and Figure 15 illustrate the timeline of natural gas facilities achieving commercial operation.

Figure 14: SC/CC - Natural Gas Capacity Added into Service by Year

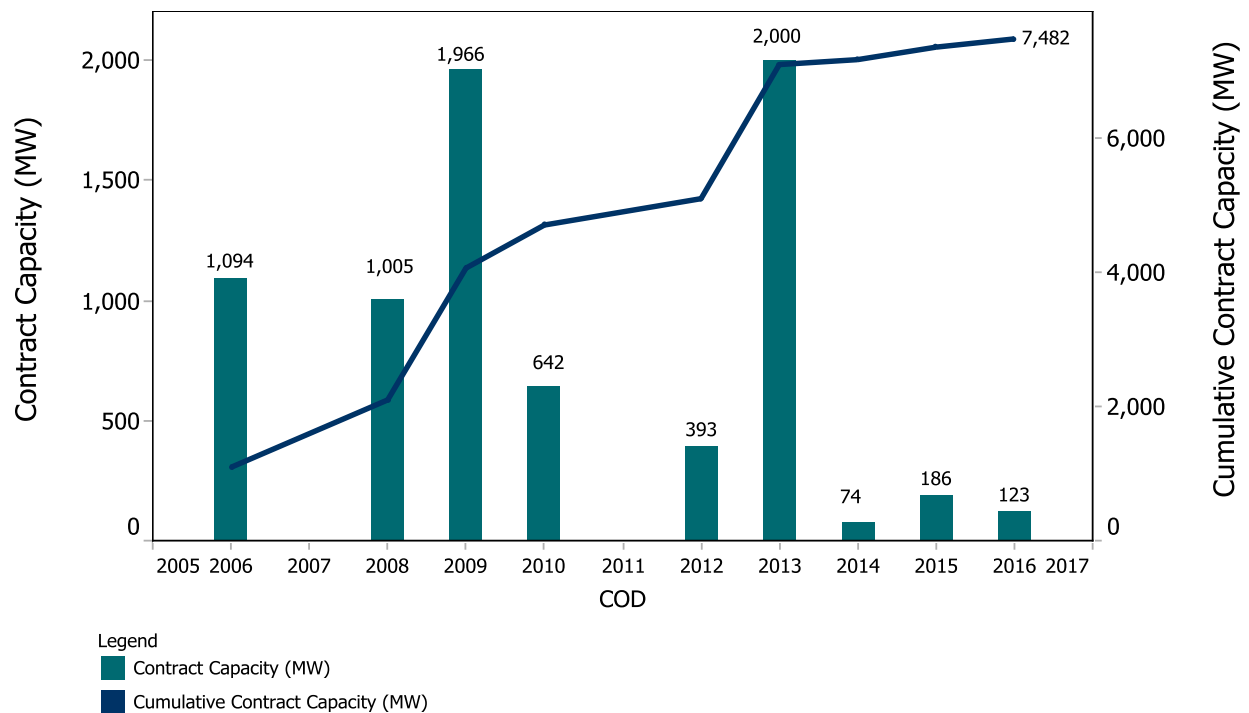
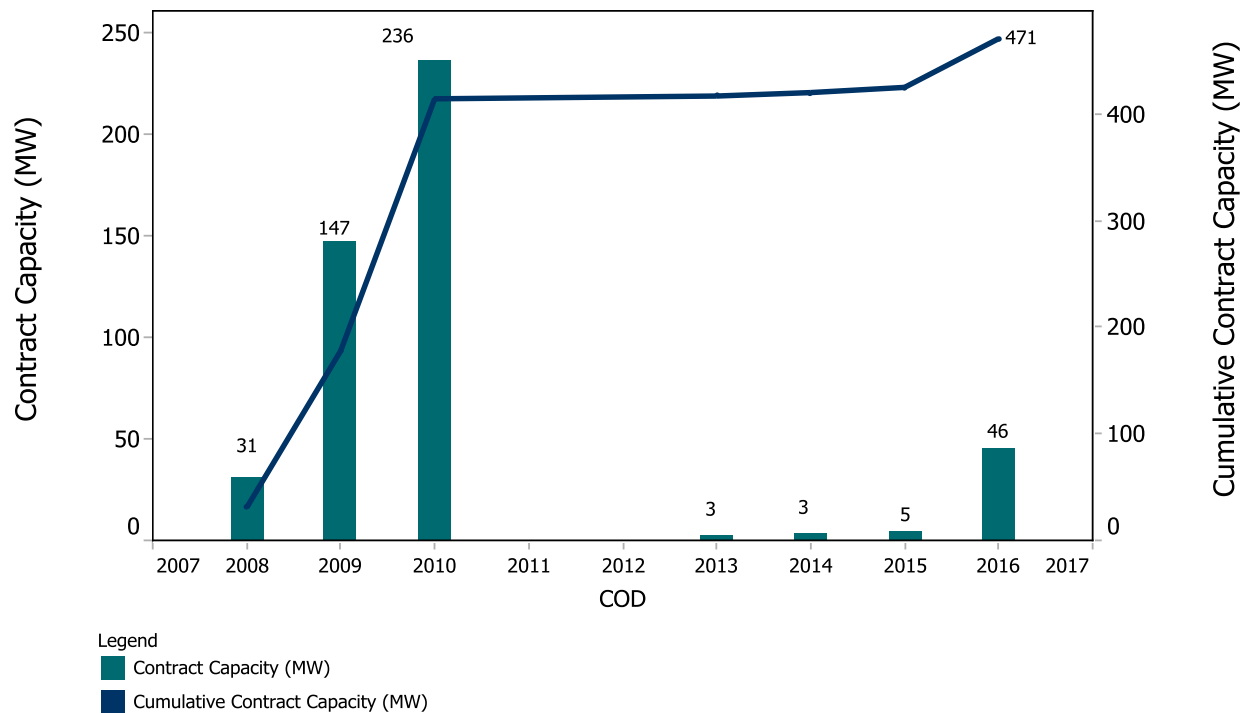


Figure 15: Cogeneration - Natural Gas Capacity Added into Service by Year

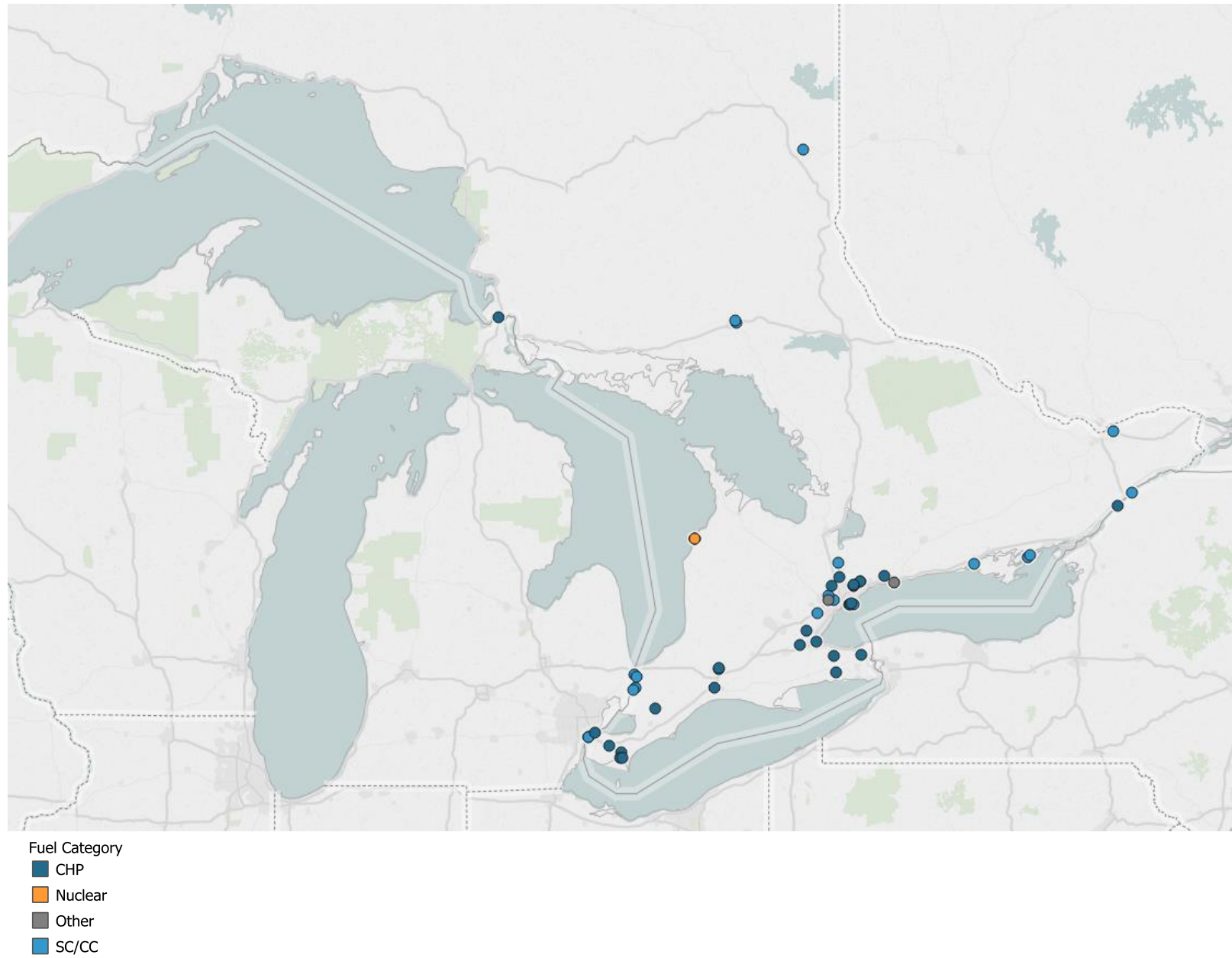
Energy from Waste

The energy-from-waste category of contracts comprises facilities that produce energy from the incineration of municipal garbage and/or waste. See the fuel type "Other" in Table 6 for further details about energy-from-waste capacity and the map in Figure 16 for the location of these facilities.

Nuclear

The IESO has 6,300 MW of nuclear capacity under contract from Bruce Power LP. The Amended and Restated Bruce Power Refurbishment Implementation Agreement (ABPRIA) took effect on January 1, 2016. Under the ABPRIA an additional 3,300 MW were contracted (Units 5-8). The ABPRIA also includes the refurbishment of six of the eight nuclear units on-site over a 14-year period, starting in 2020. The Bruce Power nuclear site is located on Lake Huron in Tiverton, Ontario and is one of the largest nuclear sites in the world. The site supplies Ontario with base load generation of over 50 terawatt hours annually, which is approximately one third of Ontario's demand.

Figure 16: Map of Non-Renewable Fuel Facilities (CO and UD)



Renewable Fuel

This section provides a synopsis of contracts for renewable fuels, which include bio-energy, hydroelectricity, solar and wind energy. The charts illustrate the capacities added each year as well as the total growth in capacity for each fuel type.

Bio-energy

Please refer to Table 12 below for details on bio-energy capacity fuel type. Figure 17 below illustrates the timeline of bio-energy capacities achieving commercial operation. Figure 18 maps the approximate location of bio-energy facilities and displays whether the project is in commercial operation or under development. The map in Figure 19 illustrates the geographic distribution of bio-energy capacity across the province.

Table 12: Number of Bio-energy Contracts and Contract Capacity

Categories		No. of Contracts		Total Capacity (MW)		% of Total Capacity		No. of Contracts	Total Capacity (MW)	% of Total Capacity
Fuel Type	Contract Type	UD	CO	UD	CO	UD	CO	Total	Total	Total
Biogas	FIT	2	21	1.0	11.7	0.2%	2.4%	23	12.7	2.6%
	RES		1		1.6		0.3%	1	1.6	0.3%
	RESOP		7		6.2		1.3%	7	6.2	1.3%
	Total	2	29	1.0	19.5	0.2%	3.9%	31	20.5	4.1%
Biogas (On-Farm)	FIT	15	14	4.1	3.4	0.8%	0.7%	29	7.5	1.5%
	Total	15	14	4.1	3.4	0.8%	0.7%	29	7.5	1.5%
Biomass	ABESA		1		205.0		41.4%	1	205.0	41.4%
	CHP		2		48.0		9.7%	2	48.0	9.7%
	FIT	3	1	1.5	17.8	0.3%	3.6%	4	19.3	3.9%
	NUG		1		5.0		1.0%	1	5.0	1.0%
	TBESA		1		135.0		27.3%	1	135.0	27.3%
	Total	3	6	1.5	410.8	0.3%	82.9%	9	412.3	83.2%
Landfill gas	FIT		4		13.8		2.8%	4	13.8	2.8%
	RES		2		7.7		1.6%	2	7.7	1.6%
	RESOP		11		33.5		6.8%	11	33.5	6.8%
	Total		17		55.0		11.1%	17	55.0	11.1%
Grand Total		20	66	6.6	488.7	1.3%	98.7%	86	495.3	100.0%

Figure 17: Bio-energy Capacity Added into Service by Year

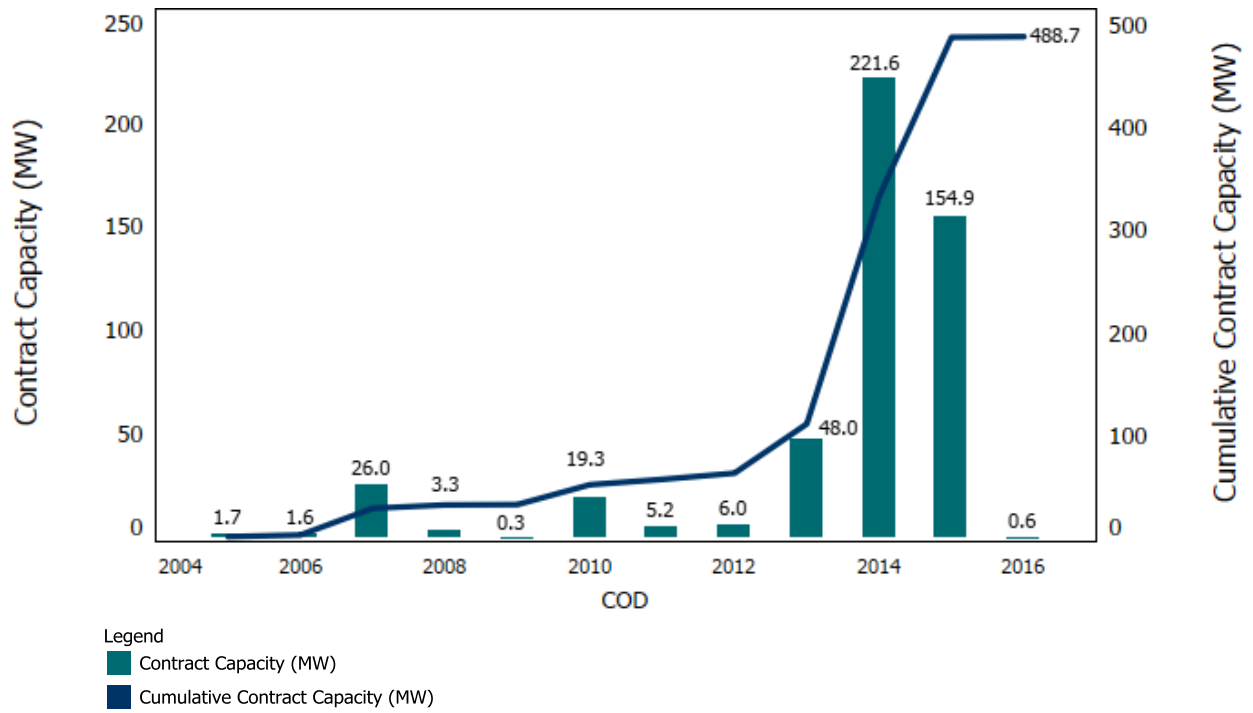


Figure 18: Map of Bio-energy Project Locations

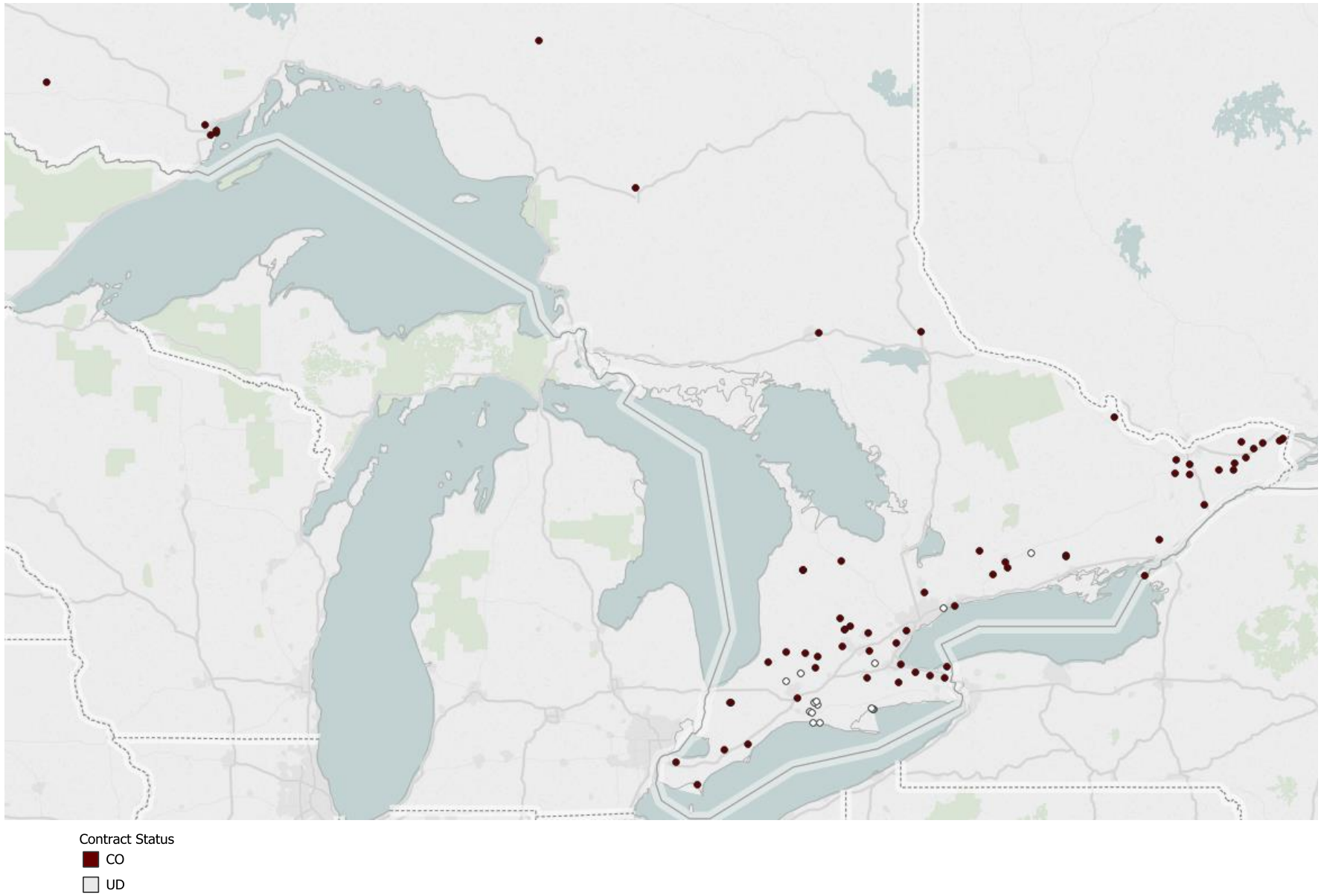
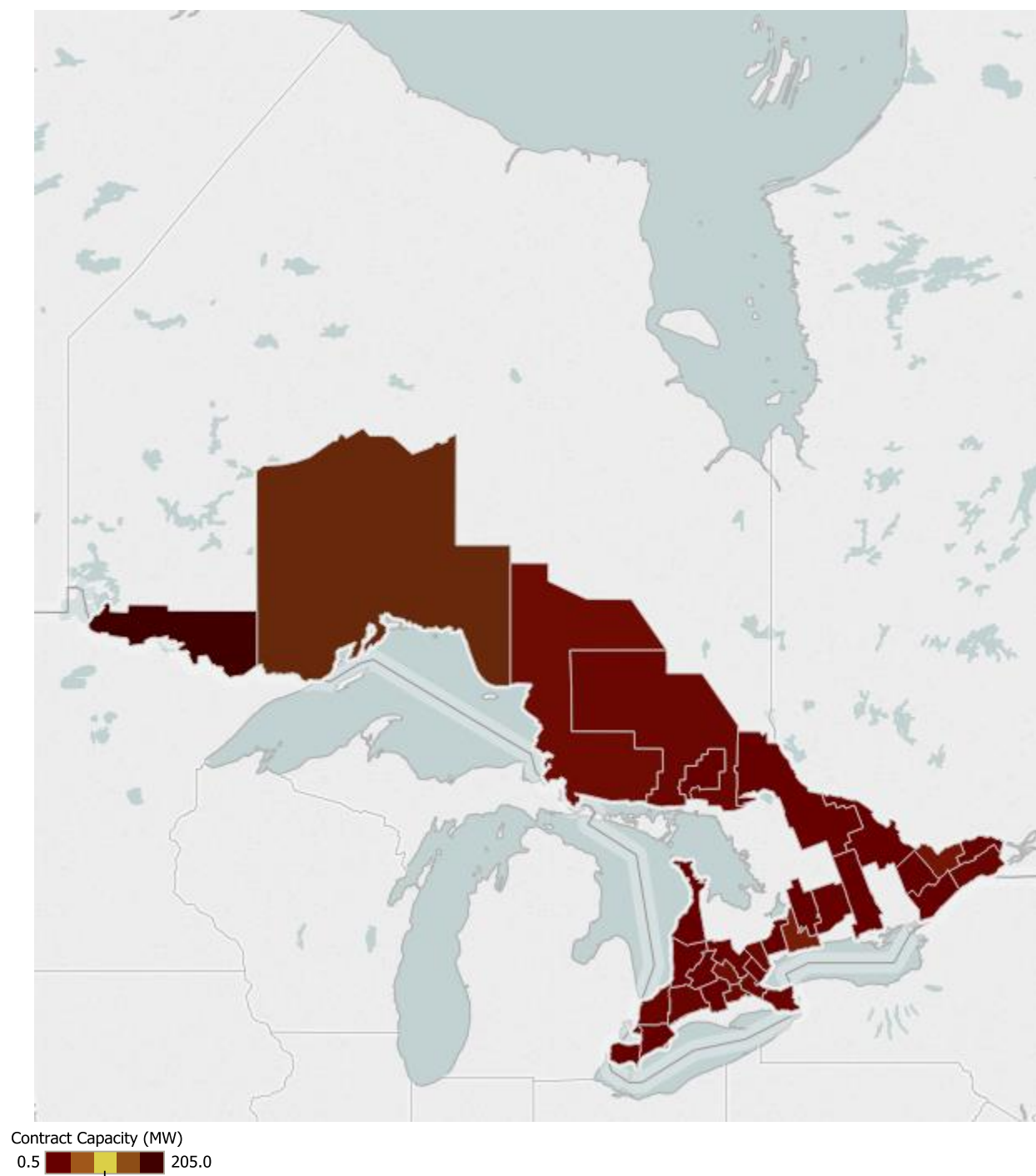


Figure 19: Map of Bio-energy Capacity In-Service



Hydroelectricity

Please refer to Table 1 and Table 6 for details on contracted hydroelectric capacity. Figure 20 below illustrates the timeline of hydroelectric capacities achieving commercial operation. Figure 21 maps the approximate location of hydroelectric facilities and displays whether the project is in commercial operation or under development. The map in Figure 22 illustrates the geographic distribution of hydroelectric capacity across the province.

Figure 20: Hydroelectric Capacity Added into Service by Year

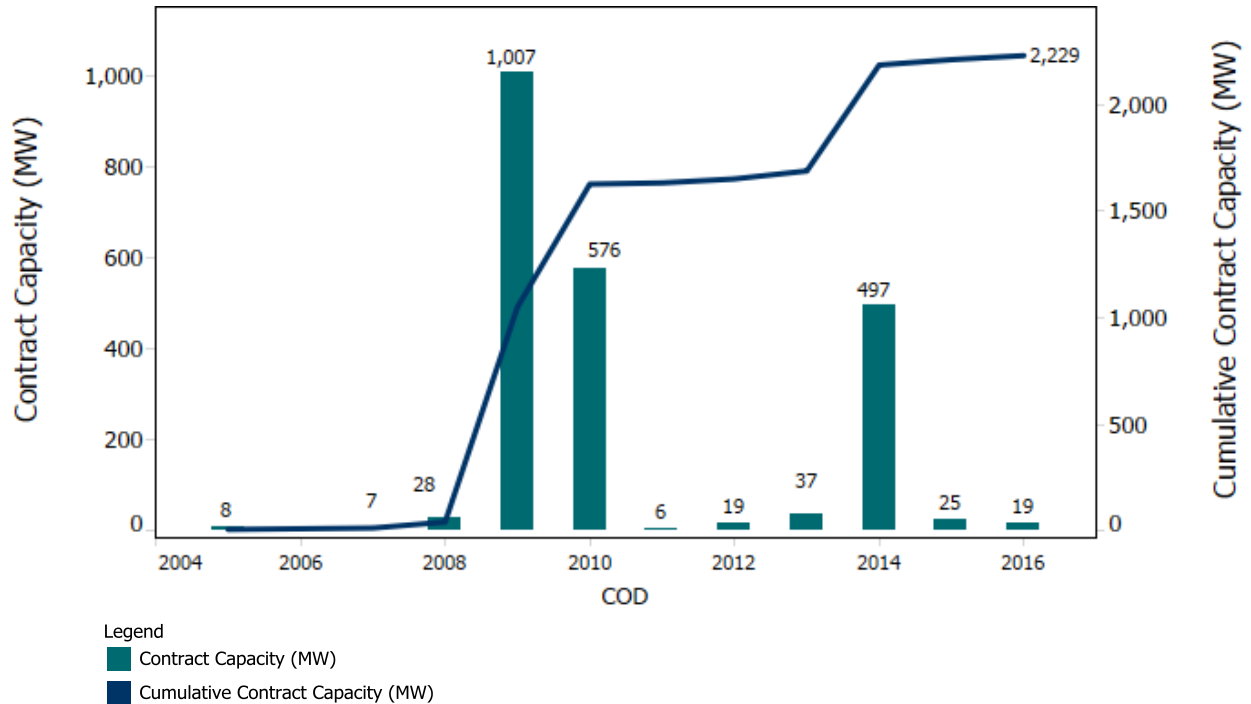


Figure 21: Map of Hydroelectric Project Locations

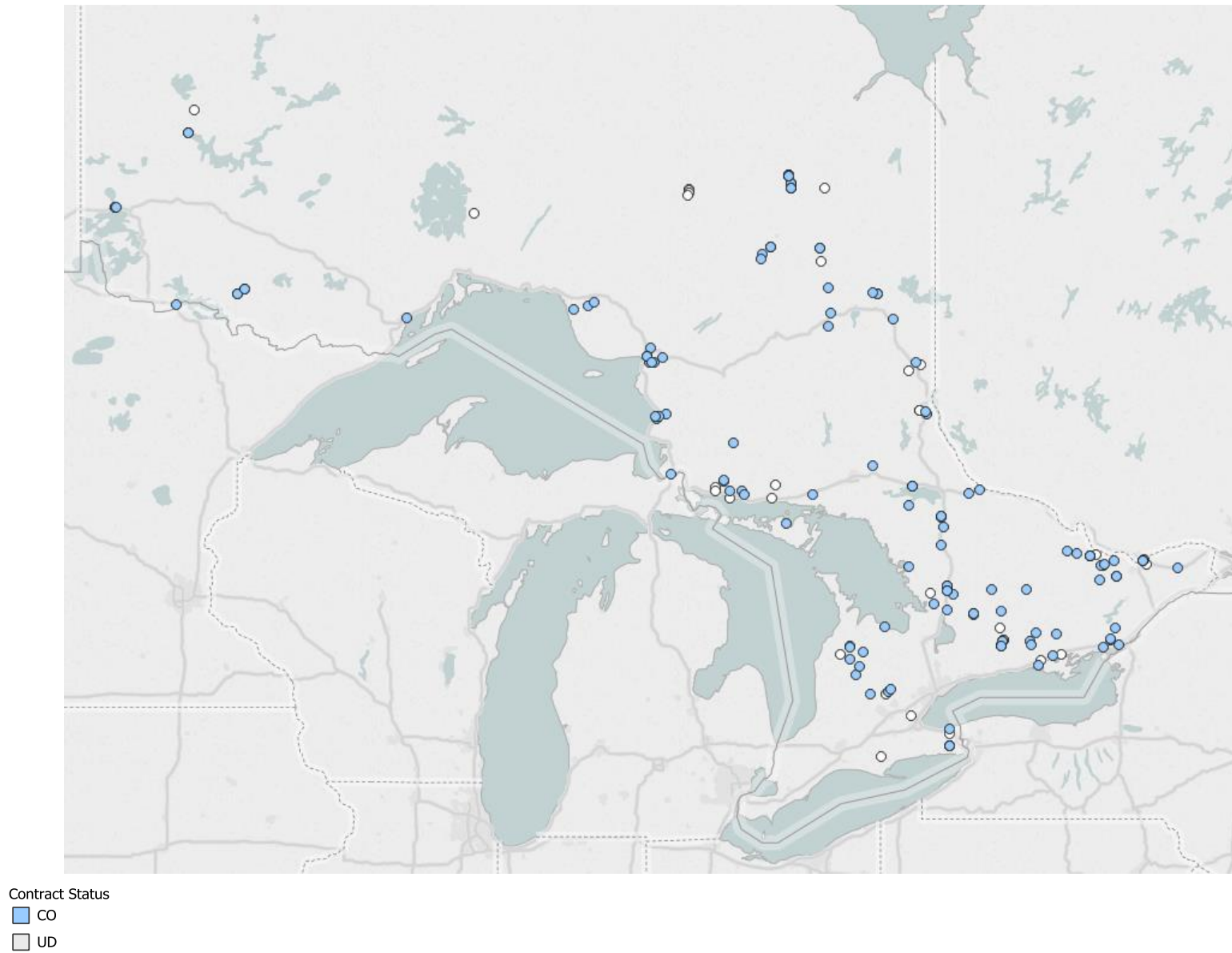
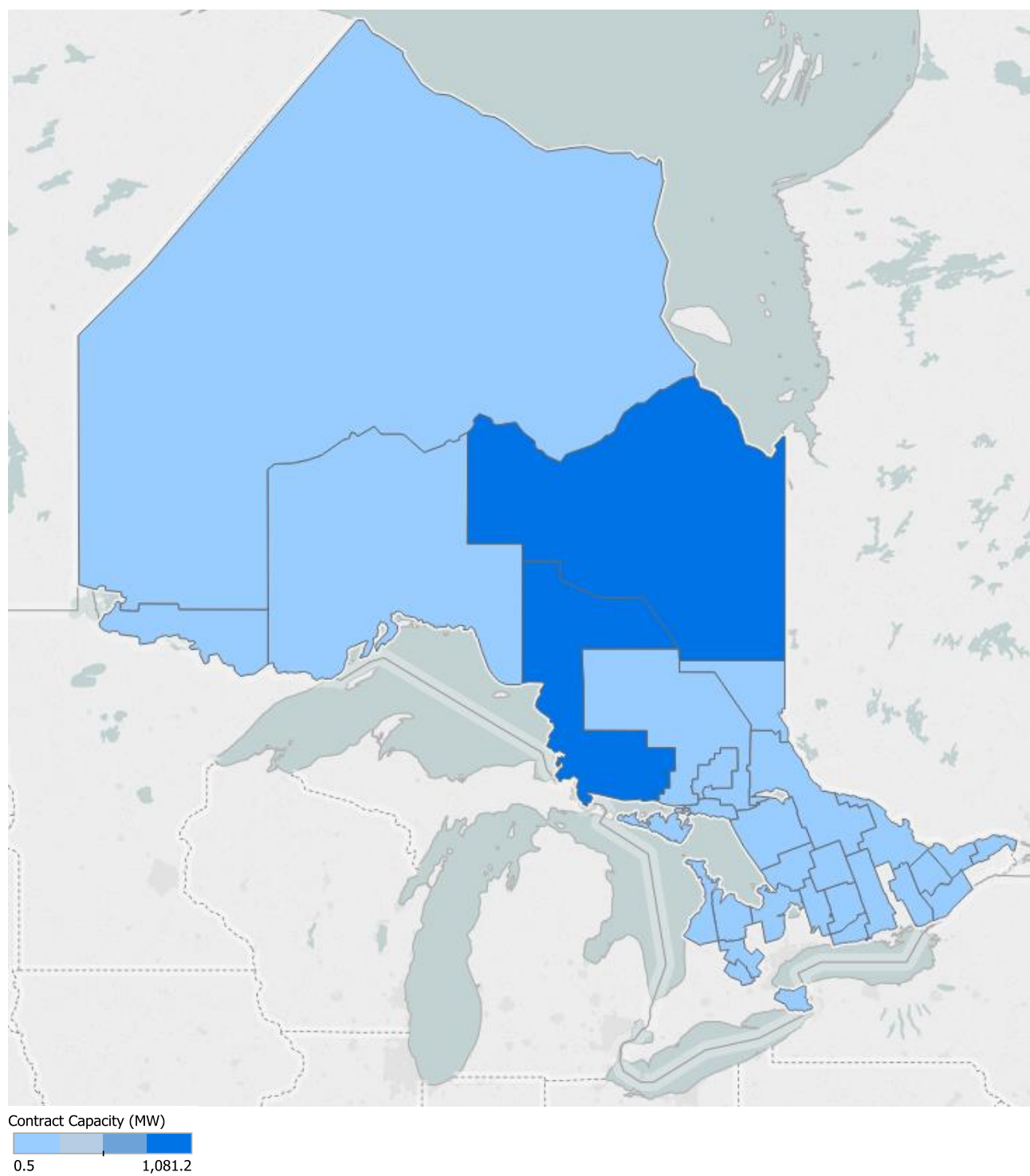


Figure 22: Map of Hydroelectric Capacity In-Service



Solar

Please refer to Table 1 and Table 6 for details on contracted solar capacity. Figure 23 below illustrates the timeline of solar capacities achieving commercial operation. Figure 24 maps the approximate location of solar facilities and displays whether the project is in commercial operation or under development. The map in Figure 25 illustrates the geographic distribution of solar capacity across the province.

Figure 23: Solar Capacity Added into Service by Year

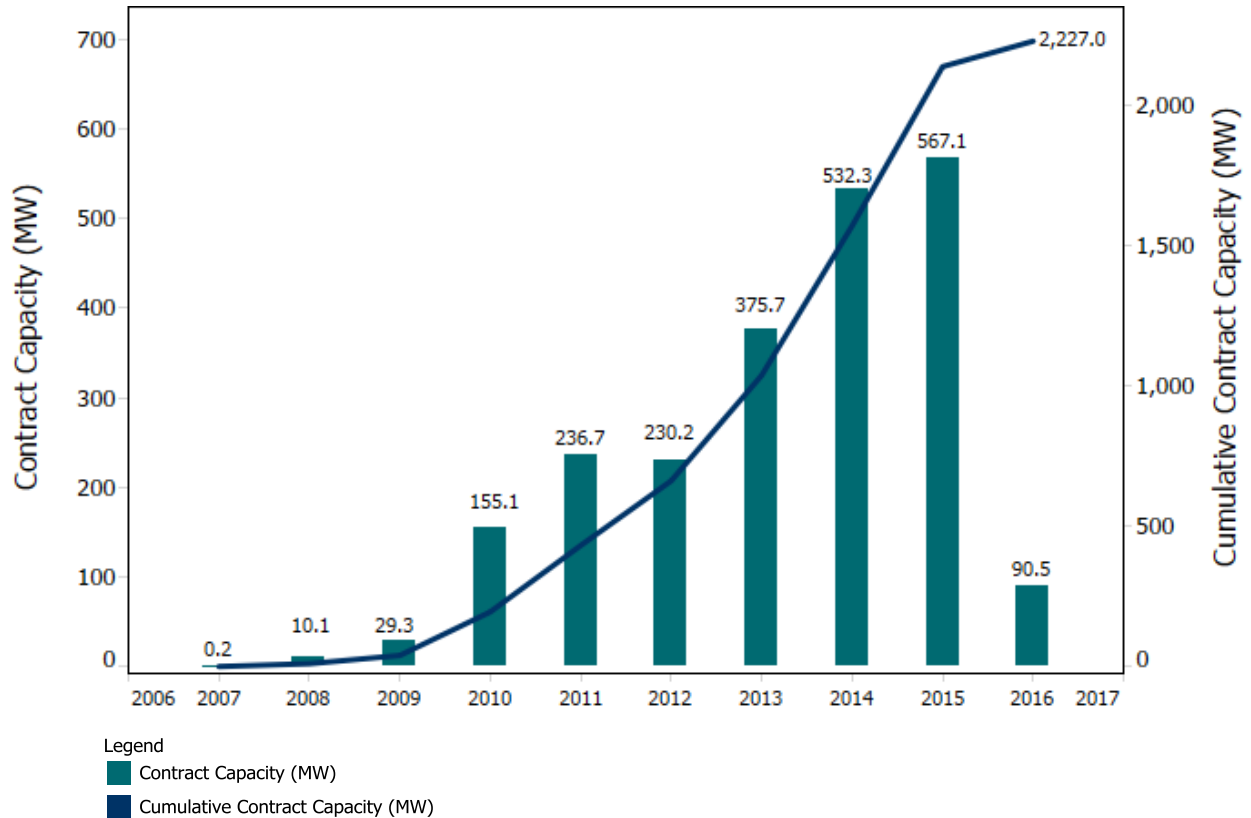


Figure 24: Map of Solar Project Locations (excluding microFIT)

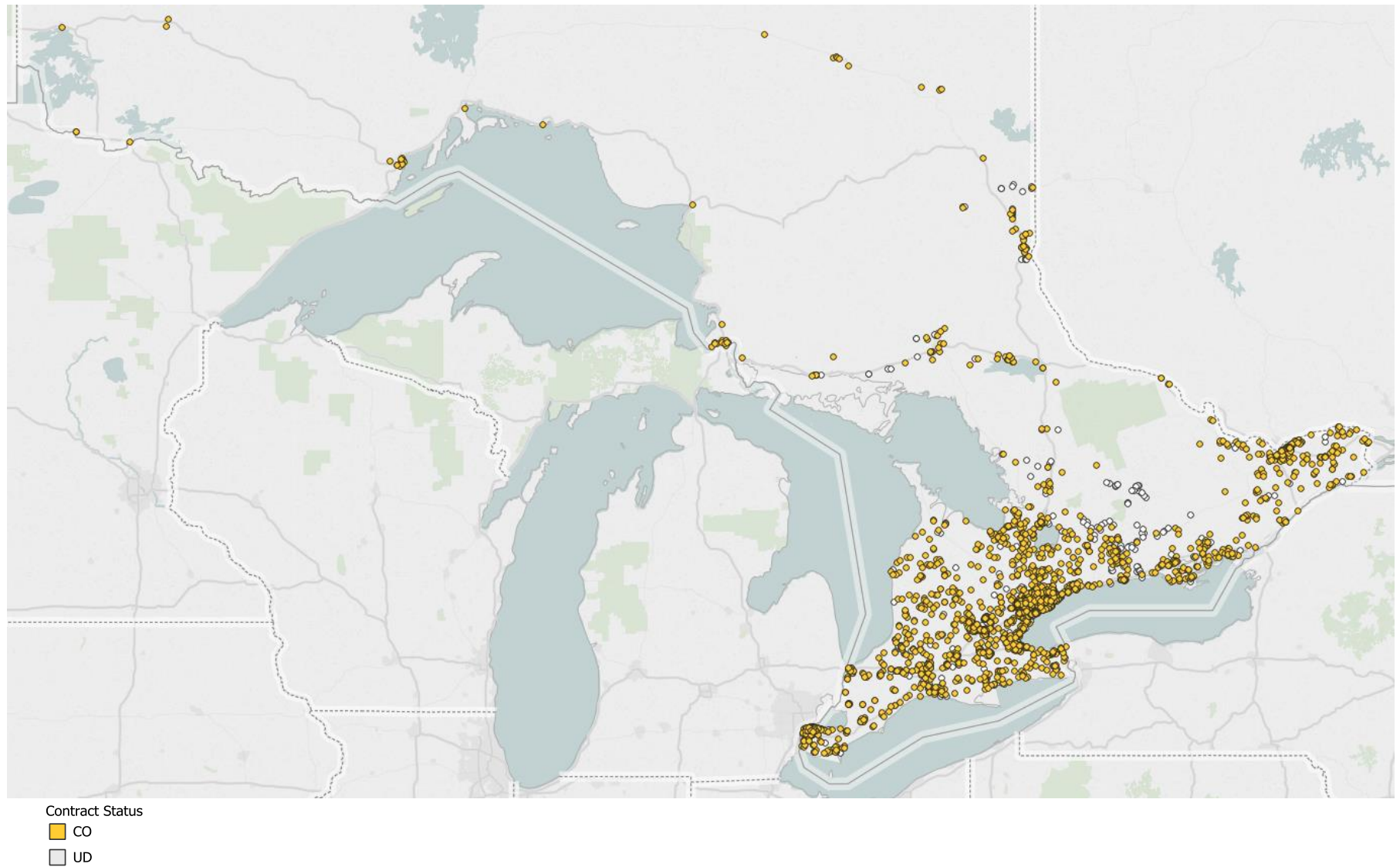
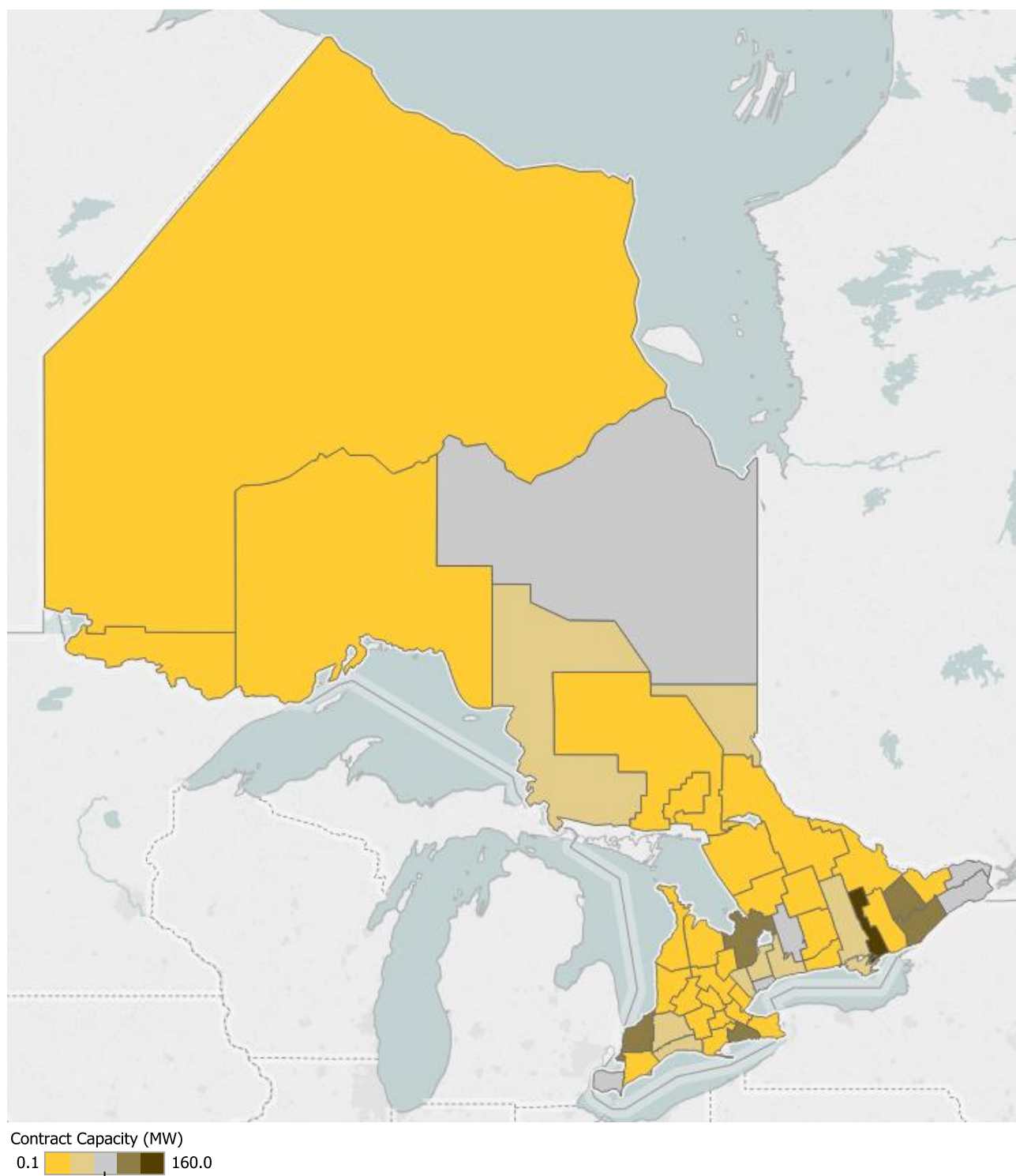


Figure 25: Map of Solar Capacity In-Service (excluding microFIT)



Wind

Please refer to Table 1 and Table 6 for details on contracted wind capacity. Figure 26 below illustrates the timeline of wind capacities achieving commercial operation. Figure 27 maps the approximate location of wind facilities and displays whether the project is in commercial operation or under development. The map Figure 27 illustrates the geographic distribution of wind capacity across the province.

Figure 26: Wind Capacity Added into Service by Year

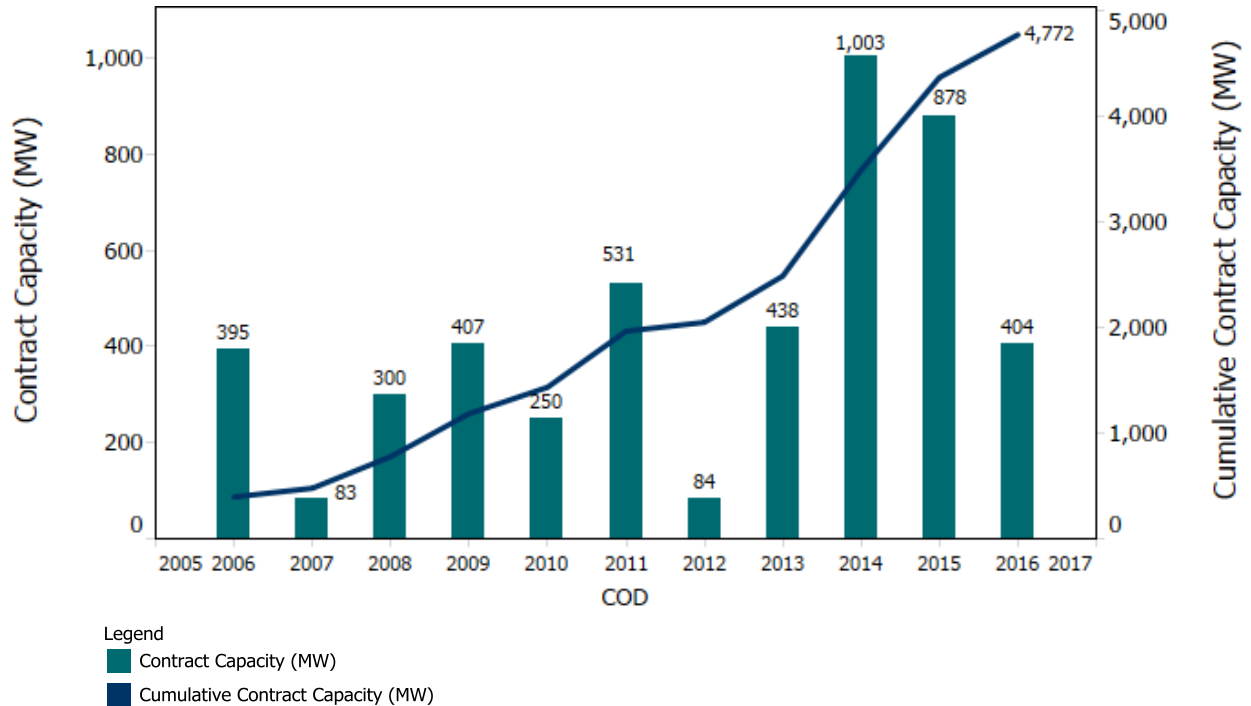


Figure 27: Map of Wind Project Locations

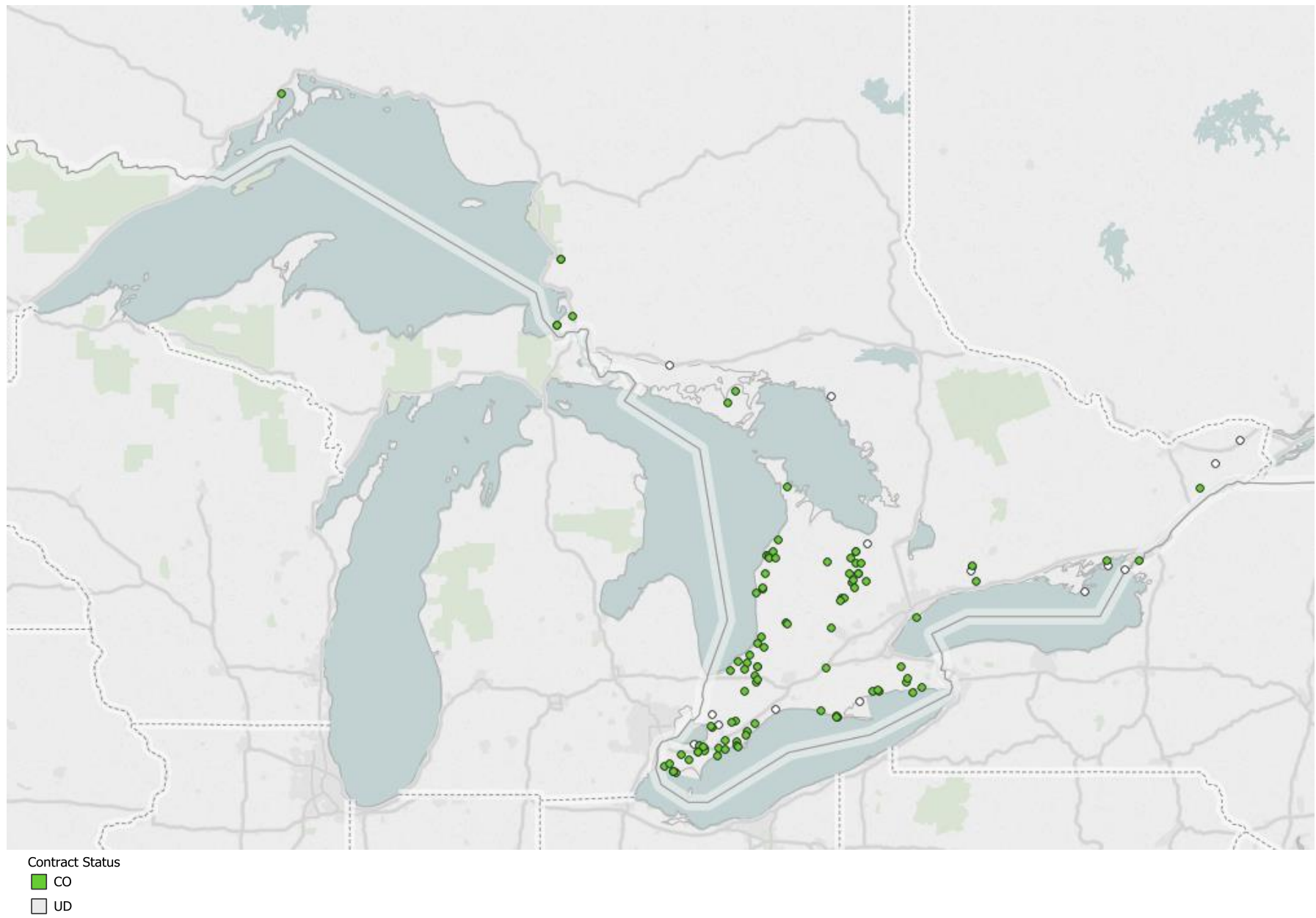
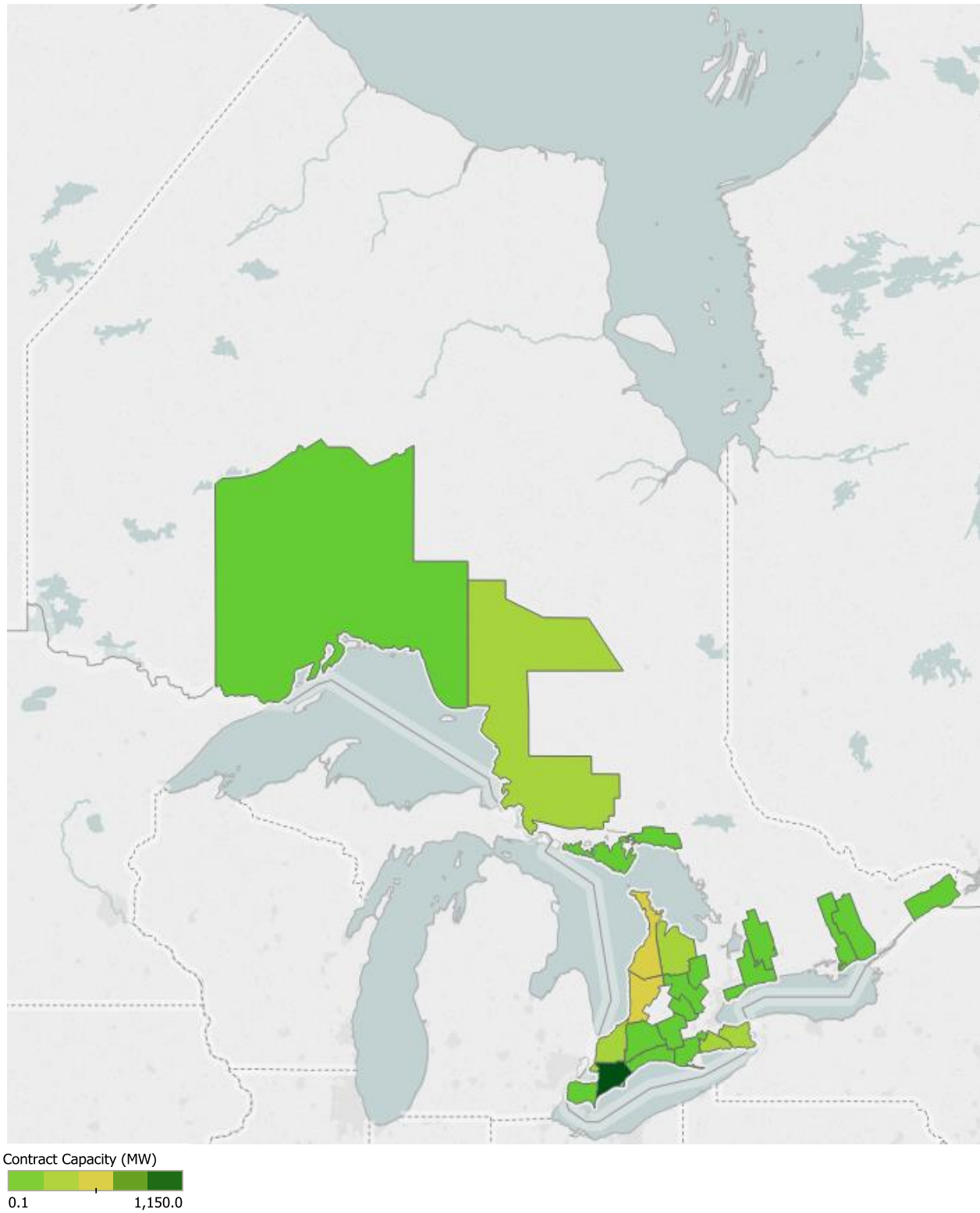


Figure 28: Map of Wind Capacity In-Service



Additional Details and Related Links

Aboriginal participation:

<http://www.ieso.ca/get-involved/indigenous-relations/overview>

IESO's FIT programs:

<http://www.ieso.ca/sector-participants/feed-in-tariff-program/overview>

Large Renewable Procurement:

<http://www.ieso.ca/Pages/Participate/Generation-Procurement/Large-Renewable-Procurement/default.aspx>

<http://www.energy.gov.on.ca/en/renewable-energy-development-in-ontario-a-guide-for-municipalities/large-renewable-procurement/>

Ministerial Directives:

<http://www.ieso.ca/corporate-ieso/ministerial-directives>

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